Dr.-Ing. Giok Djien Go

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gdgpat/pat2/pct-us

#27 Letter
08/21/00

3612

Registered

Board of Patent Appeals and Interferences
US Department of Commerce
Patent and Trademark Office
Washington DC 20231
USA

Ref: Patent Appl. No. 08/860,182 and OAS of 04/06/2000 **(E20)**
Objection to the interference by Mr Jason Morrow and Mr D. Glenn Dayoan

Dear Sirs,

I hereby object to the interference by the above-mentioned examiners to my Patent Appl. No. 08/860,182 and request you to investigate my case. The relevant communications are shaded in the accompanying Table of Chronological Enclosures. In September 1999 I twice submitted the amendments to the Claims and Abstract, addressing the objections raised in the 1st, 2nd and 3rd OAS (Office Action Summary). These amendments found the approval of the examiners as documented in the 4th OAS. In April 2000 I received the 5th OAS which is identical to the 1st OAS, apart from one page. The terms used in the Claims, Drawings and Abstract that were listed in the 1st OAS had been long changed, submitted and approved (see 4th OAS).

Why did they, Mr Jason Morrow and Mr D. Glenn Dayoan, have

1. issued the 5th OAS of 04/06/2000 **(E20)**, *which is totally untrustworthy*, despite having received
   - one set of copies of all Figs, some of which are designated by a legend "Prior Art" **(E12)**;
   - the substitute amended Claims with double spaced lines **(E10, E11, E18)**;
   - the amended Description **(E18, E19)** and

   having given their own approval **(E13)** on the substitute amended Claims with double spaced lines submitted twice **(E10, E11)**? Please investigate the loss of the submittals.
2. requested to directly fax **(E11, E15, E17a-c)** to Morrow's Office (703 308 2177) the amended Description, Claims and Abstract while denying of having received all the above-mentioned submittals? Please investigate the purpose for the direct fax transmission.
3. acted as skilled examiners having difficulties to comprehend the load cases, in the Description **(E16 to E19, E22)**, which substantiate the passenger ejection in the real-world accidents? Contrarily, the examiners of the European Patent Office *immediately granted patent* EP 0869878 B1 (see Certificate **E27**) thereon. Moreover, I had to lecture Mr Morrow the subjects of Technical Mechanics, Tolerances and Manufacturing and provide with an additional Fig. 10A, the fax **(E5)**, 50-page report **(E24a)**, police accident reports, photos and explanations by long-distance phone calls at my expenses.

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4. repeated the objection (**E1, E4, E9, E20**) to the Fig. 18 due to missing of Prior Art despite the description of new features in Chap. D, G, K pp. 8, 9 and in pp. 12/col. 20 to 39 as well as oral explanations during the phone call. Contrarily, the examiners of the European Patent Office (**E28**) had no objection!
5. demanded for a proper idiomatic English while being unfamiliar with
   - the genuine English term "post section", objected *thirsty times* in their 1st OAS, 3rd OAS and 5th OAS, and
   - the genuine English and American term "latch mechanism" (**E1, E2, E9, E20**)?

   Is their knowledge of English language far better than Mr Stuart Forbes, BSc Oxford Honour (phone +49 6126 989 959), having always reviewed all my translations and amended pursuant to Oxford English, and the examiners of the British Patent Office, having given the approval (**E14**) on the Oxford English translations of my European Patent Docs., one of which (**E21**) is attached? Taken as given, their knowledge *were superior to the Oxford Graduates* are they entitled to issue such a distorting verdict in pp. 3 (**E20**)? Furthermore, as Green Card holder and ex. employee of American Companies Prime, Computervision etc. I have applied my knowledge of very proper idiomatic American to correspond with e.g. the US Congress, Secretary of Transport The Honourable Rodney Slater (**E24**) and Canadian Transport Minister The Honourable David M. Collenette.
6. repeated the *"erroneous"* phrases of the 1st patent application, submitted on June, 05/97, in pp. 7 to 18 as well as in the 1st OAS and 3rd OAS, which had been long changed in **E10, E11, E18, E22, E25**?
7. cited *their own* Patent Rules in order to reject those *"erroneous"* phrases which absolutely comply with the US Patent Rules, hence, being written in ten US Patent Docs., listed in **E2**, and in three Docs., listed in **E3**? Please investigate the violation by *their own* Patent Rules.
8. needed five months, which could be cut in 2 minutes by printing or copying the 1st OAS of 10/08/98, to reinstate a *fussy* examination result?
9. demanded for a *perpetual* amendment of each submitted application thus ending up in my 1st patent application dated June, 05/97 and restarting therefrom to the Appls. (**E22, E25**)? Understandably, the amended Appls. (**E22, E25**) differ from the original translation (**E21**) so their demand for a marked-up specification (**E20**) is superfluous. Please investigate their idea for the *perpetual* amendment.

When changing window guide element (**E22**) to window guide channel (**E25**) and by altering some sentences into narrative ones in Hemingway's style I beg you for
- granting patent on the latest version (**E25**) and
- prolonging the patent validity by setting the US filing date of 06/22/97 to 08/22/98 to compensate the loss of at least one year?

Would you come to the conclusion that
- their groundless objections are in contradiction to the equal opportunities propagated by the US Government and
- they have impeded the progress of my work to licence the patent in USA since 1998, thus responsible for the loss of licencing fees?

Due to passenger ejection, which can be avoided only by this Patent Appl., the US Supreme Courts have imposed a fine of
- $ 259 millions on Daimler Chrysler,
- $ 295 millions and $ 173.9 millions on Ford etc.

If I must appear on a hearing to testify against Mr Morrow and Mr Dayoan, please fax me four appointment-date and your fax number.

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I, an experienced inventor as well as attorney, have completed four German Patent Docs., two European Patent Docs. (see Certificates), which have to be translated for British, French and Italian Patent Office, and several Patent Appls., on at least six of which German and European Patent will be granted in this year. Examiners of German, British, European Patent Office, PCT and WIPO have taught me of how to complete patent applications and to file in. Understandably, I am willing to learn the specific US Patent Rules. Please provide me with the list of books and the ordering list.

Would you like to forward the attached letters to the Account and Financial Dept.?
Thank you very much in advance for your reply and help to clarify this case as well as to open an account at USPTO.

kind regards

Gogiok djien

Go

Attached:
Table of Chronological Enclosures

E21. A translation of the family member EP 0869878 B1 (US 08/860,182) to the British Patent Office
E22. Submitted, amended Appl.
E23. A set of all Figs.
E24. NHSTA letter to 50-page report **(E24a)**
E25. The latest version of the Appl.
E26. Genuine English Terms "Post section" used four times in one sheer by Jaguar and "Latch mechanism" by Roltra, supplier of Fiat
E27. Four German and two European Patent Certificates
E28. Fig. 18 of EP 0869878 B1 without Prior Art

letters to the Account and Financial Dept.

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Table of Chronological Enclosures

Patent Appl. No. 08/860,182
OAS is abbreviation of Office Action Summary

Enclosure	*Date (mm/dd/yy)*	*Document*	*from*
E1	10/08/98	1st OAS	USPTO
E2	10/08/98	Objected terms in Claims of 1st OAS	USPTO
E3	12/15/98	Registered letter	Go to USPTO
E4	02/10/99	2nd Final OAS	USPTO
E5	03/18/99	Fax regarding the objection to the opposed prior art	Go to Morrow
E6	03/31/99	Fax, however, I lost the fax-confirmation	Go to Morrow
E7	05/17/99	Registered letter	Go to Morrow
E8	07/04/99	Registered submittal of the Description, Claims and Abstract	Go to Morrow
E9	08/31/99	3rd OAS	USPTO
E10	09/10/99	Registered submittal of the amended Appl. (Description, Claims and Abstract)	Go to Morrow
E11	09/10/99	Amended Claims faxed to Morrow's Office	Go to Morrow
E12	09/24/99	Registered submittal of a new set of copies of all Figs, some of which are amended	Go to Morrow
E13	10/07/99	4th OAS confirming the approval on the amended Claims and Abstract (**E10, E11**)	USPTO
E14	10/17/99	Fax disclosing no objection of British Patent Office to the translation (**E21**)	Go to Morrow
E15	10/29/99	Fax to show of how to amend the Description	Morrow
E16	11/04/99	Amended Description faxed to Morrow's Office	Go to Morrow
E17a-c	11/05/99	Amended Description faxed to Morrow's Office responsive to Morrow's Fax	Go to Morrow and Morrow to Go
E18	11/05/99	Registered submittal of the amended Appl. (Description, Claims and Abstract)	Go to Morrow
E19	11/07/99	Amended Description faxed to Morrow's Office responsive to Morrow's wish	Go to Morrow
E20	04/06/2000	5th OAS responsive to the Enclosure **E18**	USPTO

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E2

E2

Objected Claims

Objection to the terms used in claims of my patent application ref. to pp. 6 to 12 of the 1st OAS (Office Action Summary) of Oct. 08, 98

All the used terms and similar ones are found in
1) 5,806,917 Townseed
2) 4,307,911 Pavlik Budd
3) 3,819,228 Cornacchia Fiat
4) 5,480,189 Davies Ford
5) 3,860,258 Feustel Ford
6) 5,306,067 Hull Ford
7) 5,527,080
8) 5,553,803 Mitzkus
9) 5,535,553 Staser GM
10)5,555,677 De Rees Chrysler
A comparison with the objected terms is made in pp. 6 to 12.

Why have Mr Morrow and Mr Dayoan permitted the Ford Corp as well as Townseed to use the terms "latch mechanism and striker" while objecting in pp. 9 and 10?

1 5,806,917 Townsend
2 4,307,911 Pavlik Budd
3 3,819,228 Cornacchia Fiat
4 5,480,189 Davies Ford
5 3,860,258 Feustel Ford
6 5,306,067 Hull Ford
7 5,527,080
8 5,553,863 Mitzkoi.
Start 9 Gill 5,535,553
DeRees 10 Chrysler truck 5,555,677

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The following terms or phrases are inferentially recited in the claims:

In claim 1:

-line 6, the "supporting door frame".

-line 14, the "compound assemblies". Cooperating interengagable vehicle member

In claim 2:

-lines 1 and 2, the " vehicle part of vehicle body". vehicle member

-line 3, the "post sections". pillar 5 pp5/ col 51.

In claim 3: post. 2 pp1/ col 30, 34, 45

-line 2 of claim 3, the "vehicle part".

In claim 4:

-line 2, the "vehicle part".

In claim 6:

-line 3, the "interlocking holes". interengagable elements 4a, 4b 3 pp 2/ col 53.

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block". housing / box

-line 6, the "mutual post section". common

In claim 7:

-line 3, the "interlocking holes". receptacles

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block". h-

-line 7, the "side rail".

In claim 8:

-line 2, the "U-shaped block".

In claim 9:

receptacles keys.

-line 2, the "interlocking holes & interlocking blocks"

-line 3, the "post section". pillar

-

In claim 10:

-lines 5 and 6, the "post section". 4 pp2 / col 58

see pp.9 -line 6, the "reinforcing panel". 5 2/ 31,34

-line 7, the "side rail". 6 sill pp 2/col 28

In claims 12 and 13: 2 side sill pp6/col 5

-line 3, "interlocking holes".

-line 3, the "reinforcing panels".

-line 5, the "interlocking mating blocks".

In claim 14:

-line 3, the "interlocking blocks".

-line 3, the "reinforcing peripheral edges". 5 reinforced edges

-line 5, the "interlocking mating holes". marginal flange

In claim 15:

-line 3, the "interlocking block".

-line 4, the "top peripheral edge". top

-line 5, the "interlocking mating holes".

In claim 16:

-line 4, the "bottom peripheral edge".

-line 3, the "interlocking block".

In claim 17:

-line 3, the "interlocking block".

-lines 3 and 4, the "post-section peripheral edge".

-line 5, the "interlocking mating hole".

-line 5, the "auxiliary part".

In claim 19:

- line 3, the "interlocking block".

-line 4, the "post-section peripheral edge".

-line 5, the "interlocking mating hole".

-line 5, the "outer door-contour-shaped auxiliary part".

In claim 20:

-line 5, the "post section".

In claim 21:

(1) door latch pp 7/ col 62

-line 2, the "post section".

-line 4, the "interlocking blocks".

(6) reinforcing means, plate pp 3/ col 32, 37 pp 2 / col 53 pp 4 / col 36-37

(1) pp 10/ col 32 -lines 4 and 5, the "reinforcing element".

(F) pp 2/ col 64-64 -line 5, the "latch mechanism". (L) pp 1/ col 30 latch assembly pp 2/ col 18 pp 4/ col 2 (striker!

(D) door locks pp 2/ col 18-19

-line 6, the "interlocking mating holes".

-line 7, the "post section".

In claim 22:

-line 3, the "interlocking block". housing 8 Abstract

-line 4, the "interlocking mating hole".

-lines 4 and 5, the "reinforcing element".

-line 5, the "striker". 6 pg 2/ col 15 7 stud

-line 5, the "latch mechanism". 6

In claim 23:

-line 3, "the interlocking block".

-line 5, the "interlocking mating hole".

-line 5, the "post section".

-lines 5 and 6, the "reinforcing element".

-line 6, the "striker".

-line 6, the "latch mechanism".

In claim 24: GM 9

-line 2, the "U-shaped window-guide element".

window - guide

channel

In claim 25:

-line 2, the "U-shaped window-guide elements".

In claim 26:

-lines 2 and 3, the "window-guide~~s~~". elements

window guide channels

GM 5 pp2 / col 58

In claim 27:

-lines 1 and 2, the "window guides". tracks pp3/ col 11

In claim 28:

-line 4, the "interlocking hook".

-line 5, the "interlocking block".

In claim 29:

-line 2, the "washer". Correct word (term)

In claim 30:

-line 2, the "screw". bolt

In claim 31:

E3

E3

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Mr Jason Morrow
Group Art Unit 3612
USPTO
Washington DC 20231

Objection to the patentability of US. 5,806,
Examination report of Oct. 8, received Oct. 22
Patent Appl. No. 08/860,182
PCT/DE 96/02120 (DE 195 43 706 A1)
my 3-page fax plus two enclosures of 11/06/98

12/15/98

Dear Mr Morrow,

Fatality of a driver of BMW's convertible car [10] is evidence for the failure of BMW's US 4.676,524 which is significantly improved by MB's 5,284,360. Owing to attached MB's DE 4344604 C1 the construction of MB's roof is stiffened, however, the reinforced roof of MB E320 [12] was totally deformed due to lack of *reliable* interlocking assemblies.

The PCT/DE96/02120, EP 0869878 B1, CA 2,220,872 and US 08/860,182 consists of the Appl. DE 19543706 and extended Appl. DE 19645925. Both German Application Forms are attached

Allow me please to compare your objections to my terms in my previous patent application with those of US Patent attorneys

your objections	US Pat. Nr	my new terms
said	common use in US Pat. Docs	I've totally eliminated
passenger compartment	Porsche's 5,562,329 e.g. in Abstract, pp. 1/col. 25, 46 etc. Porsche's Attorneys have completed the Patent Docs. of BMW, MB etc.	vehicle body despite the proper words "passenger compartment" (cell).
door truss		door frame
means	Claims of 4,307,911	none
title comprising two to seven words	10 words in 4,307,911	exactly seven

I appreciate your correct objections to some Figs., which must be denoted by "Prior Art", Claims, violating the USPTO-Rules, but not German, European Patent-Rules.
I may refer to the correct words of "form-locking connection", explained in Chap. "Noteworthy" in pp. 5 and my skill as one the most talented Attorney confirmed by the

Deutsche Post AG
Einlieferungsbeleg
Postvermerk
Deutsche Post AG 65185 Wiesbaden 1
02 7954 6839 5DE EPn Int
88651195 2079 15.12.98 11:10
ggf. Identnummer einkleben, Tagesstempel anbringen, unterschreiben
Unser Service-Telefon
0180 5/29 06 90 (15 Sek. kosten 0,12 DM)
Montag – Freitag, 09.00 – 18.00 Uhr
Angaben des Kunden
Wir empfehlen Ihnen, nachstehende Felder auszufüllen bzw. anzukreuzen:
z. B. Empfänger, PLZ, Bestimmungsort oder andere kundenbezogene Angaben:
USPTO US Department of Commerce
Washington DC 20231
USA / Mr Jason Morrow
Wichtige Hinweise auf der Rückseite!

PAT2.
Nov. 07, 98
→ PAT5

Please hand it over to Mr Jason Morrow
Group Art Unit 3612

my 3-page fax of 11/03,98

List of Patent Docs/Appls mentioned in PCT/DE96/02120 (08/860,182) based on (*2), which is extended patent appl. of (*1)

DE 19543706 A1 (*1)	Germany	11/17/95
DE 19645925 (*2)	Germany	11/07/96
DE-PS 1755661	Germany	06/06/68
DE-OS 2162071	Germany	12/24/70
DE 3103580 A1	Germany	01/07/82
DE 3726292 C1	Germany	02/23/89
DE 4342038 A1	Germany	12/09/93
EP 423465 A	Europe	10/18/89
EP 642940 A (*3)	Europe	09/09/93

(*3) patent family member US 5,518,290

examiners of German Patent and European Patent Office granting patent on the following within short period of 11 months:

- enclosed European Patent 0869878 B1 (family member of US 08/860,182, CA 2,220,872), EP 0844939 B1,
- DE 19615785 C1, DE 19636167 C1, DE 19711392 C1, DE 19549378,
- DE 197 49 780, 197 58 497, 197 58 498, all these three must be amended for the purpose of patent-granting upon receiving the official examination reports.

What is the use of securing the service of US Attorneys, who would use phraseology violating the USPTO-Rules and need my teachings? This is the reason why the examiners of the German Patent, European Patent Office and WIPO have taught me to formulate Claims etc. in order to save their life upon implementation of my inventions in cars, trains and aeroplanes. Please read my enclosed report [1] and the reply of NHTSA [19] thereon. However, I do have secured the help and service of an Oxford Graduate Stuart Forbes in order to have phraseology in compliance with Oxford English.

The claim 32 corresponds to claim 20 of the EP 0869878 B1, whose total claims of 35 were requested on the enclosed registered letter of Dec. 15, 97 to EP Office.
Would you help me to amend my new patent appl. in compliance with USPTO-Rules in order to amend my other pending US- patent appls.?
Thank you for your help and efforts in advance.

I may wish you Merry Christmas and Happy New Year.

Sincerely

Go

Dr. Go

<u>Attached:</u>
European Patent 0869878 B1 (family member of US 08/860,182)
letter of Dec. 15, 97 to EP Office to request the permission for claim 20
new patent appl., Figs., all publications, claims in double-space lines, disk
US 5,284,360, DE 4344604 C1
German Application Form of DE 19543706 and extended Application Form of DE 19645925

I've already mailed to you the following appls/docs:

DE 19543706 A1 (*1)	Germany	11/17/95
DE 19645925 (*2)	Germany	11/07/96
DE-PS 1755661	Germany	06/06/68
DE-OS 2162071	Germany	12/24/70
DE 3103580 A1	Germany	01/07/82
DE 3726292 C1	Germany	02/23/89
DE 4342038 A1	Germany	12/09/93
EP 423465 A	Europe	10/18/89
EP 642940 A (*3)	Europe	09/09/93

PCT/DE96/02120 is based on Patent appl. (*1) and extended Patent appl. (*2).
(*3) patent family member US 5,518,290

E5

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ES

Mr Jason Morrow
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USPTO

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Patent Appl. No. 08/860,182 mailed Dec. 12, 98
Inapplicability of US. 5,806,917

Dear Mr Morrow,

03/18/99

Thank you for your 2nd examination report of 02/10/99, which was delivered 02/20/99.
Allow me please to deliver my first review thereon:

A. Inapplicability of Townseed's method to reduce clearances in col. 10/lines 38-59, Fig. 12 and *10A to minimum tolerances*:
Each tapered key 130 has four faces associated with four clearances F1 to F4 and a depth clearance F5 in loose engagement with the mating receptacle 134. On the use of six interengaging assemblies a vehicular connection member of door & vehicle body must be provided with 6 x 5 = 30 clearances plus three clearances between the stud 298 and catch of door lock 248, thus totalling 33 clearances. Despite meticulous, very pricey rework (repair) by injecting hardenable resin in the receptacle the problem of a high number of clearances *remains unresolved*. Dr. Reichenbachs interengaging assembly ref. to German Patent Doc. 1755611 includes a cone-shaped key and the mating receptacle, thus yielding two clearances, less than Townseed's assembly, plus three clearances for door lock, thus totalling five clearances. The problem of clearances *remains unresolved*. When the tolerances between mating members of door lock are perfectly adjusted the key and mating receptacle *must be* in loose interengagement. After more than two decades Daimler Chrysler has stopped the production of Reichenbachs assemblies.
Townseed has **not** anticipated
- huge costs to rework and repair. Should the rework be carried out in the assembly line that must be stopped for injection work of hardenable resin? If injection work is made outside of assembly hall, must the car be repainted in the assembly line when the remaining resin smears the vehicle body and/or resin spills thereover? Is hardenable resin coating capable of sustaining large forces?
- problem of a high number of clearances and reject rate. When at least one of six interengaging assemblies are in interference due to problem case D " Constant, small contour-clearance" *in pp. 4/lines 16-27*, the door can never be closed!
- increasing problem of a high number of clearances and larger reject rate due to additional clearances of new door latch in col. 7/lines 56 to col. 8/lines 2 in Fig. 9 and 10.
- load cases I to IV described in pp 3 of my US 08/860,182 and
- passenger ejection in rollover due to *disengagement of Townseed's assemblies* resulting in door detachment when the deformed vehicle body 20 is deflected in *DE_x-direction* shown *in Fig. 10A. See my principle measures to resolve the failure of prior art in Fig. 3A, 4A, 3, 15 and 16.*

Townseed's invention was already patented by Nissan ref. to Fig. 1A and DE-OS 2162071 of 07/06/72, whose shortcomings are described in *pp. 5/lines 34-50.*
The well experienced examiners of PCT- and European Office have given a positive verdict on *my countermeasures* and, later on, granted *patent EP 0869878 B1* thereon.

S. 1

* * * KOMMUNIKATIONSERGEBNISBERICHT (17.MÄR.1999 22:07) * * *
TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
356	SPEICHER SENDEN		VSPTO	OK	S. 3/3

B. My German Patent Application DE 19543706 A1, stored in CD, can be read in any Patent Office for the purpose of certifying. Furthermore, PCT-Office and EP Office have meticulously examined the DE 19543706 A1 and DE 19645925, both together are merged into PCT/DE96/02120, which is similar to the family members US 5,518,290 and EP 0869878 B1.
However, in order to meet the US requirement I, having mailed a registered request of confirmation to DPA (German Patent Office), will show you the original version and the examination report of DE 19543706 A1, the examination report of DE 19645925 and both original filing forms in a hearing.

C. I have made a list of Americanised phrases, whereto you objected, ref. to US Patent Docs, e.g.:
In Claim 10 "side rail" ref. to US 5,480,189 col. 3/line 58; US 3,860,258 col. 2/lines 31, 34.
In Claim 21 "latch mechanism", changed into "door lock", ref. to US 5,306,067 col. 1/line 38, col. 2/line 18, col. 4/line 3. Would you accept "aperture-guide", "aperture-guide member" replacing "window-guide", " window -guide element"?

D. I have already amended all claims and the following *narrative* abstract:
On closing the door, that is conventionally hinged to a pillar, keys of interengagable assemblies smoothly engage with mating receptacles located on both pillars, the vehicle roof and side rail. The smooth interengagement is ensured by the adjusting mechanisms of the keys, which are located on the front, rear, upper and lower edges of the door. In an accident the door is coupled with the mating door-aperture in the vehicle chassis whereby energy is distributed to the integrated vehicle chassis.
In the second feature of invention, the interengagable assemblies of a vehicular connection-member, consisting of the edge of the door and a member of the vehicle chassis, are arranged in at least two operating planes.
In the third feature, the deformation of the two doors of one vehicle side and their common pillar is constrained in an accident due to a housing, rigidly attached to the common pillar and accommodating the keys, which tightly engage with the mating receptacles located on the rear edge of the front door and the front edge of the rear door.
This inventive technology is applicable for other door types such as tailgate-, sliding side-, cargo-, liftgate doors, trunk cover and hood to define a substantially stiffer vehicle chassis whereby stress is enormously reduced in an accident.

Due to th above-mentioned and additional review there is a need to meet you. I wish to
- present the list, other paper work, appls, forms and docs in original version,
- have your consent for prolonging the expiration date because DPA needs *time to confirm the existence of* DE 19543706 A1 and
- discuss with you in a hearing about the failure of the prior art in relation to load cases I to IV, assembling doors ref. to problem case D, door detachment and total deformation of vehicle chassis by showing a lot of police-accident reports and photos of failure of Reichenbachs, new assemblies, door locks of accident-involved MBs, BMWs, VW VR6, VWs, Opel Omegas (Cadillac Catera) etc.

I would appreciate your help to return my previous appl. being corrected and arranged according to US Patent rules. Should I mail you the *draft* of the amended appl. before a hearing takes place?

On March 22, 24 or 25 between 1 to 4 p.m. at your local time I would phone you.
Thank you very much for your help and interest.

kind regards

Go   Gogiskadjian

<u>Attached:</u> Fig 12 and 10A

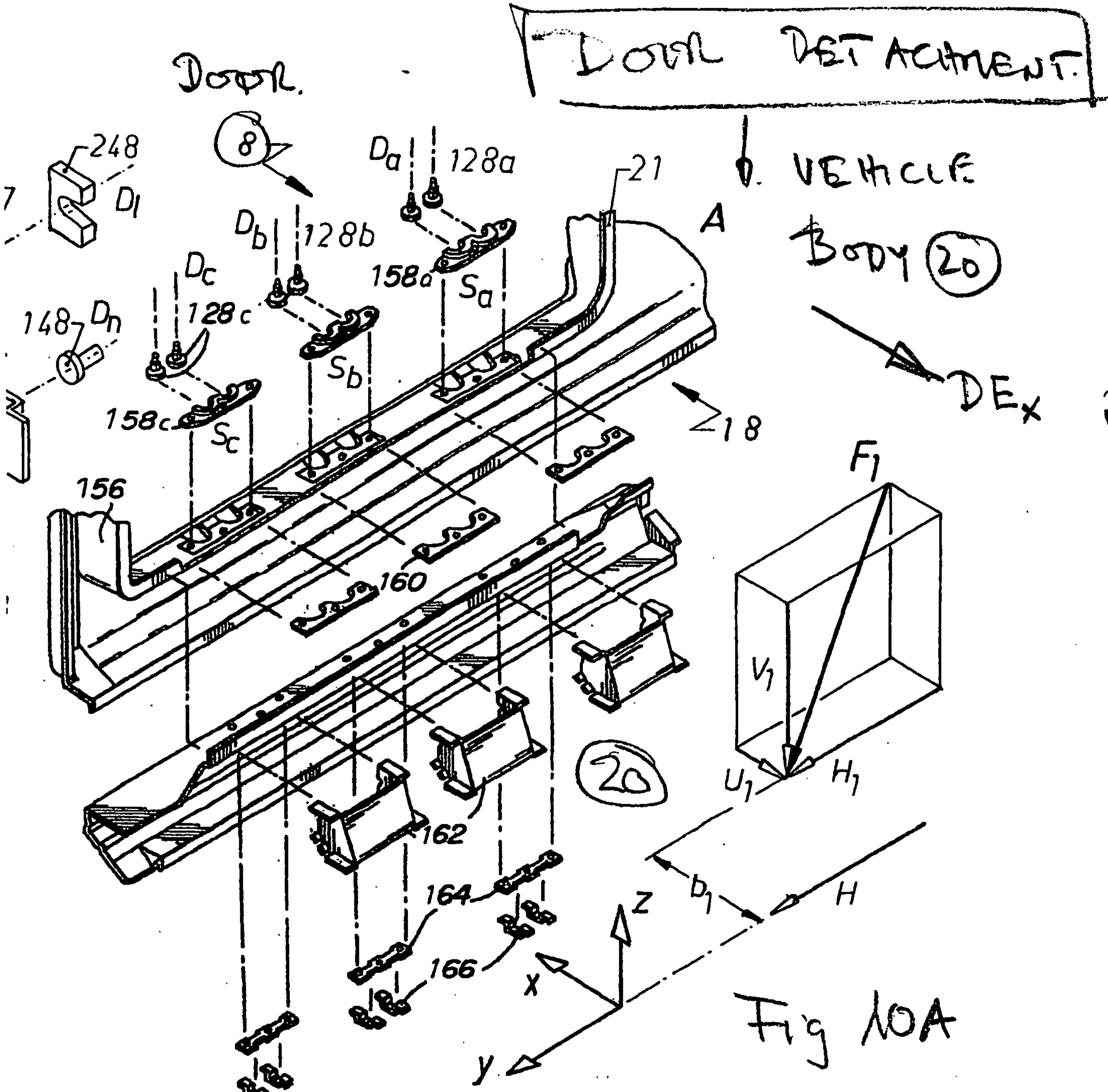

Fig 10A

GO

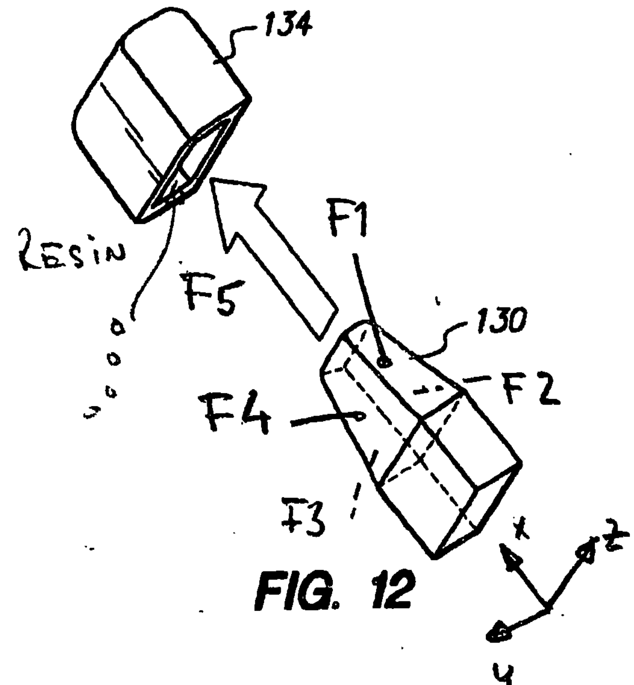

FIG. 12

F1-F5

Townsend.

EC

EC

Giok Djien Go
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Mr Jason Morrow
Group Art Unit 3612
USPTO

Patent Appl. No. 08/860,182

ABSTRACT

Dear Mr Morrow, 03/31/99

Would you like to review the abstract and fax me the amended back please?

On closing the door, that is conventionally hinged to a pillar, keys of interengagable assemblies smoothly engage with mating receptacles located on both pillars, the vehicle roof and side rail. The smooth interengagement is ensured by the adjusting mechanisms of the keys, which are located on the front, rear, upper and lower edges of the door. In an accident the door is coupled with the mating door-aperture in the vehicle chassis whereby energy is distributed to the integrated vehicle chassis.

In the second feature of invention, the interengagable assemblies of a vehicular connection-member, consisting of the edge of the door and a member of the vehicle chassis, are arranged in at least two operating planes.

In the third feature, the deformation of the two doors of one vehicle side and their common pillar is constrained in an accident due to a housing, rigidly attached to the common pillar and accommodating the keys, which tightly engage with the mating receptacles located on the rear edge of the front door and the front edge of the rear door.

This inventive technology is applicable for other door types such as tailgate-, sliding side-, cargo-, liftgate doors, trunk cover and hood to define a substantially stiffer vehicle chassis whereby stress is enormously reduced in an accident.

Thank you very much for your help and interest.
kind regards

Go

E7

E7

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phone/fax +49 6126 8949

Registered

Mr Jason Morrow
Group Art Unit 3612
USPTO

Patent Appl. No. 08/860,182

Dear Mr Morrow,

05/17/1999

The President of German Patent Office has made a confirmation on the certified copy of DE 19543706.3 which meets the USPTO rule.

Thank you for your interest.

kind regards

Go giok djien

Go

Attached:
Confirmation of 10. May and certified copy

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E8

Deutsche Post AG

Einlieferungsbeleg

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Mr Jason Morrow
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US Department of Commerce
Patent and Trademark Office
Assitant Commissioner for Patents
Washington DC 20231
USA

CPA Forms for Patent Appl. No. 08/860,182
Entitled of Small Entity
Amendment of Appl. No. 08/860,182

07/04/99

Dear Mr Morrow,

Thank you for faxing the CPA forms, which as enclosures are filled out.
I have already sent two checks of $ 465 and $ 632. Would you like to tell the Finance Dept. of USPTO to deposit the remaining $ 781 in an account wherefor I am applying?

Please review the amended description and claims with reference numeral in normal space, double space as well as claims without reference numeral in normal space. Would you amend the claims and fax me please?

Thank you for your interest.

kind regards

Go Giok Djien

Go

Attached:
CPA forms
Description and claims with/without reference numeral in normal space, double

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- [ ] Nachnahme

Nachnahme-Betrag in DM

912 666 000 1/98

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Sept No 1, 99

Registered

Mr Jason Morrow
Group Art Unit 3612
Customer Service Center, Initial Patent Examinat
US Department of Commerce
Patent and Trademark Office
Assitant Commissioner for Patents
Washington DC 20231
USA

CPA Forms for Patent Appl. No. 08/860,182
Entitled of Small Entity
Amendment of Appl. No. 08/860,182
EP 0869878 B1

Dear Mr Morrow,

Enclosed you find my registered letter of 07/04/99, copy of European Patent Doc, which is the parent patent of US 08/860,182, and the amended description as well as claims.

Please review the amended description and claims with reference numeral in normal space, double space as well as claims without reference numeral in normal space. Would you amend the claims and fax me please?
Today I fax you the amended claims with reference numeral.
I 'll phone you on 16 Sept. at 3 pm.

Thank you for your help to open account and interest.

kind regards

Go Go giok djien.

total weight of submittal of approx. 390 gr.
weight of description and claims with/without reference numeral of 204 gr.

Attached:
CPA forms
Description and claims with/without reference numeral in normal space, double space
EP 0869878 B1 and certificate

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E12

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Mr Jason Morrow
Group Art Unit 3612
Customer Service Center, Initial Patent Examination Div.
US Department of Commerce
Patent and Trademark Office
Washington DC 20231

Patent Appl. No. 08/860,182
examination report of 08/31/99, received on 09/24/99
my submittal of 09/10/99 and fax of amended claims on 09/10/99

09/24/99

Dear Mr Morrow,

On our today phone call you indicated that the above-mentioned examination report is not valid anymore. Enclosed you find a set of copies of all the figures.

Thank you for your interest.

kind regards

Go giok djien

Go

Attached:
a set of copies of all the figures

Einlieferungsbeleg **Deutsche Post AG**

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Figs
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Wichtige Hinweise auf der Rückseite!

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Mr Jason Morrow
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US Department of Commerce
Patent and Trademark Office
Washington DC 20231

Fax 703 305 7687

Patent Appl. No. 08/860,182
USPTO letter of Oct. 7, mailed on Oct. 12, received on Oct. 17 (a five-day mail)

Dear Mr Morrow,

10/17/99

A delay of ten days should be reckoned on the expiration period of thirty days, which would end on Nov. 17. However, I hope to submit the amended description at the first week of Sept.

Without objection the British Patent Office in Newport has accepted the original translation of EP 0869878 B1, which does not include the additional explanation found in Appl. No. 08/860,182. On my last phone call you mentioned to fax me the pages which must be readable (comprehensible). Tomorrow I will contact you in order to amend those pages.

Thank you for your interest and help.

kind regards

Go Go giok djien

S. 1

* * * KOMMUNIKATIONSERGEBNISBERICHT (17.OKT.1999 22:24) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
672	SPEICHER SENDEN		VSPTO	OK	S. 1/1

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E 18

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Washington DC 20231
USA
Wichtige Hinweise auf der Rückseite!
Einwurf
Übergabe-
Eigenhändig

Patent Appl. No. 08/860,182

11/05/99

Dear Mr Morrow,

the failure to fax you the remaining pages from 16 to 29 was, I presume, due to the shut-up of all Department fax machines at 5 pm. I left you a message in your phone box to forward the paper work by mail.
Please fax back your suggestion.

Thank you for your interest and help.

kind regards

Go

Attached:
Description and claims with/without reference numeral in normal space, double space
Fig. 15

E24

E24

U.S. Department of Transportation
National Highway Traffic Safety Administration

400 Seventh Street, S.W.
Washington, D.C. 20590

NOV 24 1998

AIR MAIL

Dr.-Ing. Giok Djien Go
Pfahlgrabenstr. 45
D-65510 Idstein
Germany

Dear Dr. Go:

Thank you for your letters to Secretary of Transportation Rodney E. Slater regarding your inventions of occupant protection devices. Your letters have been forwarded to the Office of Vehicle Safety Research of the National Highway Traffic Safety Administration (NHTSA) for our review.

NHTSA is an agency under the U.S. Department of Transportation which is responsible for reducing deaths, injuries, and economic losses resulting from motor vehicle crashes. Towards this objective, this agency conducts research to develop an understanding of human injury mechanisms in crashes and to develop countermeasures that address the safety problems. The aim of this effort is to support the development of and/or upgrade Federal motor vehicle safety standards. However, NHTSA does not endorse specific products. Rather, the applicable performance requirements of relevant safety standards must be met by the product.

We strongly encourage the marketplace development of any system that can increase safety. You may wish to approach the automotive industry or their suppliers to determine if there is an interest in further development of your safety systems for installation in new vehicles.

The agency appreciates your commitment to development of safety systems for crash protection, and we encourage your continued interest.

Sincerely,

Joseph N. Kanianthra

Joseph N. Kanianthra
Director
Office of Vehicle Safety Research

E26 Complimentary ?c

JA GUAR

E26

Europäisches Patentamt
European Patent Office
Office européen des brevets

Publication number: **0 472 284 A1**

EUROPEAN PATENT APPLICATION

Application number: 91306483.8

Int. Cl.[5] B60J 5/04

Date of filing: 17.07.91

Priority: 21.08.90 GB 9018350

Date of publication of application: 26.02.92 Bulletin 92/09

Designated Contracting States: DE FR GB IT SE

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67 The Hamlet
Leek Wootton, Warwickshire CV35 7QW(GB)

Representative: Watts, Peter Graham
Anthony Cundy & Co. 384 Station Road
Dorridge
Solihull West Midlands B93 8ES(GB)

Vehicle bodies.

post section 4 times

A vehicle body (10) has a door aperture (11) the door aperture (11) being bounded along its lower edge by a sill section (12) and by forward and rearward upstanding post sections (13 and 14). a door (15) being located in the door aperture (11). the door (15) being hinged to one post section (13) and releasably engaging catch on the other post section (14). a tie bar (20) is provided adjacent the edge of the door (15) remote from the sill section (12). clamping elements (25. 26; 36. 31. 38) being provided for releasably clamping the tie bar (20) with respect to both the forward and rearward post sections (13. 14) when the door (15) is closed. the tie bar (20) being capable when clamped of transmitting tensile. compressive and torsional loads from one post section (13) to the other post section (14).

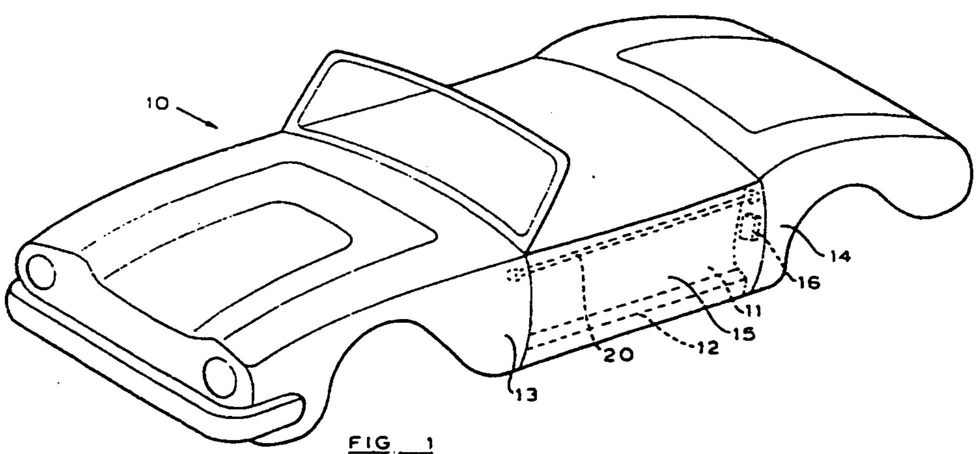

FIG 1

EP 0 472 284 A1

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Rottra

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seal 14 (Figure 2), and to outer panel 2 via a second known seal (not shown) also fitted to outer panel 2.

Window 13 is moved in relation to outer panel 2 and between an open and closed position by a known window regulator 15 forming part of preassembly 3, housed inside cavity 10, and supported inside cavity 10 on a plate 16, the opposite end portions of which are connected integral with respective intermediate portions of portion 9. More specifically, window regulator 15 comprises a slide 36 connected integral with the bottom peripheral portion of window 13 and operated by a known link drive 17. Drive 17 is in turn operated by an electric motor 18, the supply cables 19 of which are fitted to plate 16 and terminate in respective terminals connected to the terminal board of a cable assembly 20 (shown partially in Figure 1) extending towards the central portion of the vehicle. Assembly 20 is fitted to panel 8, and is preferably embedded inside panel 8 when this is formed or during assembly of preassembly 3.

As shown in Figure 1, plate 16 is also fitted with a known door lock mechanism 21 also forming part of preassembly 3 and comprising a lock 22 with a top lever for connection to the outside door handle (not shown), and a known power operated safety door lock device 23 with supply cables 24 also connected to panel 8 and connected in known manner to cable assembly 20.

As shown in Figure 1, preassembly 3 of door 1 is fitted to outer panel 2 by means of a number of elastic appendixes 25 fitted to and spaced along the inner surface of portion 11 of panel 8, and each of which positively engages a respective seat or opening 26 formed in portion 6 of outer panel 2. Preassembly 3 is also fitted to outer panel 2 by means of a number of fastening elements 27 (Figure 2) extending through respective holes 28 in a peripheral portion of portion 9 of panel 8, and positively engaging - preferably clicking inside - respective holes 29 in a peripheral portion of portion 4 of outer panel 2.

Door 1 as described above is produced by first forming preassembly 3 and then fitting it to outer panel 2. More specifically, preassembly 3 is formed by fitting window regulator 15 and lock mechanism 21 to plate 16; inserting plate 16 inside cavity 10 in panel 8 formed beforehand, for example, by molding; fitting plate 16 removably to portion 9 of panel 8; electrically connecting supply cables 19 and 24 of motor 18 and device 23 respectively to assembly 20 already embedded inside, and hence integral with, panel 8; fitting cables 19 and 24 to plate 16 or portion 9 of panel 8; and, finally, fitting window 13 to both panel 8, by fitting it on to respective seal 14, and to window regulator 15 by fitting the bottom portion of window 13 on to slide 36.

Once assembled, preassembly 3 is picked up, preferably by means of a robot fixture (not shown) or by an operator, and positioned facing outer panel 2, and more specifically in such a position that each appendix 25 corresponds with a respective seat 26, and holes 28 correspond with holes 29.

At this point, preassembly 3 is moved towards outer panel 2; panel 8 is pressed on to outer panel 2 so that appendixes 25 positively engage respective seats 26; and, still pressing panel 8 on to outer panel 2, fastening elements 27 are inserted inside respective holes 28 and driven into holes 29.

Bottom portion 9 of panel 8 is thus connected removably to portion 4 to complete the bottom portion of door 1; while top portion 11 of panel 8 is connected removably to frame 6 with which it defines a channel for window 13, and at the same time covers frame 6 to complete the top portion of door 1.

A pretested preassembly of the type described above thus provides for greatly simplifying assembly of the door and, more especially, for enabling a drastic reduction in on-line assembly, testing and revision time, by virtue of supplying the assembly line with no more than two parts, one consisting of metal outer panel 2, and the other of all the other, preassembled, working components of the door.

Also, by virtue of supplying the assembly line with only two parts which are easily connectable to each other, this may be done using fully automatic robot fixtures, thus enabling a reduction in the skilled labour still required at present for assembling known doors.

Clearly, changes may be made to door 1 as described and illustrated herein without, however, departing from the scope of the present invention. For example, panel 8 need not necessarily present portion 11 or the whole of portion 11; window 13 need not necessarily form part of the preassembly, and may be fitted to outer panel 2 in known manner and to respective slide 36 during fitment of preassembly 3 to outer panel 2; and changes may be made to elements 25 and 27 for connecting preassembly 3 to outer panel 2.

Moreover, panel 8 need not necessarily present cavity 10 or pocket 10a, and window regulator 15 and door lock mechanism 21 may be housed in a cavity formed in outer panel 2, in which case, plate 16 may be dispensed with and portion 9 may be reinforced, for example, by means of ribs.

Finally, as opposed to being embedded in panel 8, cable assembly 20 may simply be fitted to the surface of panel 8 using known fastening elements such as brackets or terminal strips screwed to or embedded in panel 8.

lock mechanism

E27

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Urkunde Certificate Certificat

Es wird hiermit bescheinigt, daß für die in der beigefügten Patentschrift beschriebene Erfindung ein europäisches Patent für die in der Patentschrift bezeichneten Vertragsstaaten erteilt worden ist.

It is hereby certified that a European patent has been granted in respect of the invention described in the annexed patent specification for the Contracting States designated in the specification.

Il est certifié qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet ci-joint, pour les Etats contractants désignés dans le fascicule de brevet.

Europäisches Patent Nr. **European Patent No.** **Brevet européen n°**

0869878

Patentinhaber **Proprietor of the Patent** **Titulaire du brevet**

Go, Giok Djien, Dr.-Ing.
Pfahlgrabenstrasse 45
65510 Idstein/DE

München, den
Munich,
Fait à Munich, le

28.07.99

Ingo Kober

Präsident des Europäischen Patentamts
President of the European Patent Office
Président de l'Office européen des brevets

EPA/EPO/OEB Form 2031 01.96

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Il est certifié qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet ci-joint, pour les Etats contractants désignés dans le fascicule de brevet.

Europäisches Patent Nr. | European Patent No. | Brevet européen n°

0844939

Patentinhaber | Proprietor of the Patent | Titulaire du brevet

Go, Giok Djien, Dr.-Ing.
Pfahlgrabenstrasse 45
65510 Idstein/DE

München, den
Munich,
Fait à Munich, le 30.12.98

Ingo Kober

Präsident des Europäischen Patentamts
President of the European Patent Office
Président de l'Office européen des brevets

BUNDESREPUBLIK DEUTSCHLAND

URKUNDE

über die Erteilung des

Patents

Nr. 195 49 378

IPC: B60N 2/06

Bezeichnung:
Sitzverstelleinrichtung für einen PKW oder LKW-Sitz mit mindestens zwei Schienenpaaren

Patentinhaber:
Go, Giok Djien, Dr.-Ing., 65510 Idstein, DE

Erfinder:
gleich Inhaber

Tag der Anmeldung: 17.08.1995

München, den 10.06.1999

Der Präsident des Deutschen Patent- und Markenamts

Dipl.-Ing. Norbert Haugg

BUNDESREPUBLIK DEUTSCHLAND

URKUNDE

über die Erteilung des

Patents

Nr. 196 36 167

IPC: B60K 5/12

Bezeichnung:
Frontcrashbedingte Aggregatstrennung bei PKW und LKW

Patentinhaber:
Go, Giok Djien, Dr.-Ing., 65510 Idstein, DE

Erfinder:
gleich Inhaber

Tag der Anmeldung: 06.09.1996

München, den 29.01.1998

Der Präsident des Deutschen Patentamts

Dipl.-Ing. N. Haugg

BUNDESREPUBLIK DEUTSCHLAND

URKUNDE

über die Erteilung des

Patents

Nr. 196 15 985

IPC: B62D 25/20

Bezeichnung:
Bodengruppe eines Fahrzeuges mit Mitteln zur Erhöhung des Insassenschutzes

Patentinhaber:
Go, Giok Djien, Dr.-Ing., 65510 Idstein, DE

Erfinder:
gleich Inhaber

Tag der Anmeldung: 22.04.1996

München, den 21.08.1997

DEUTSCHES PATENTAMT

Der Präsident des Deutschen Patentamts

Norbert Haugg

Dipl.-Ing. N. Haugg

BUNDESREPUBLIK DEUTSCHLAND

URKUNDE

über die Erteilung des

Patents

Nr. 197 11 392

IPC: B60R 21/02

Bezeichnung:
Lenksäule und Sicherheitsgurte eines Fahrzeuges mit Schutzvorrichtung

Patentinhaber:
Go, Giok Djien, Dr.-Ing., 65510 Idstein, DE

Erfinder:
gleich Inhaber

Tag der Anmeldung: 19.03.1997

München, den 29.10.1998

DEUTSCHES PATENTAMT

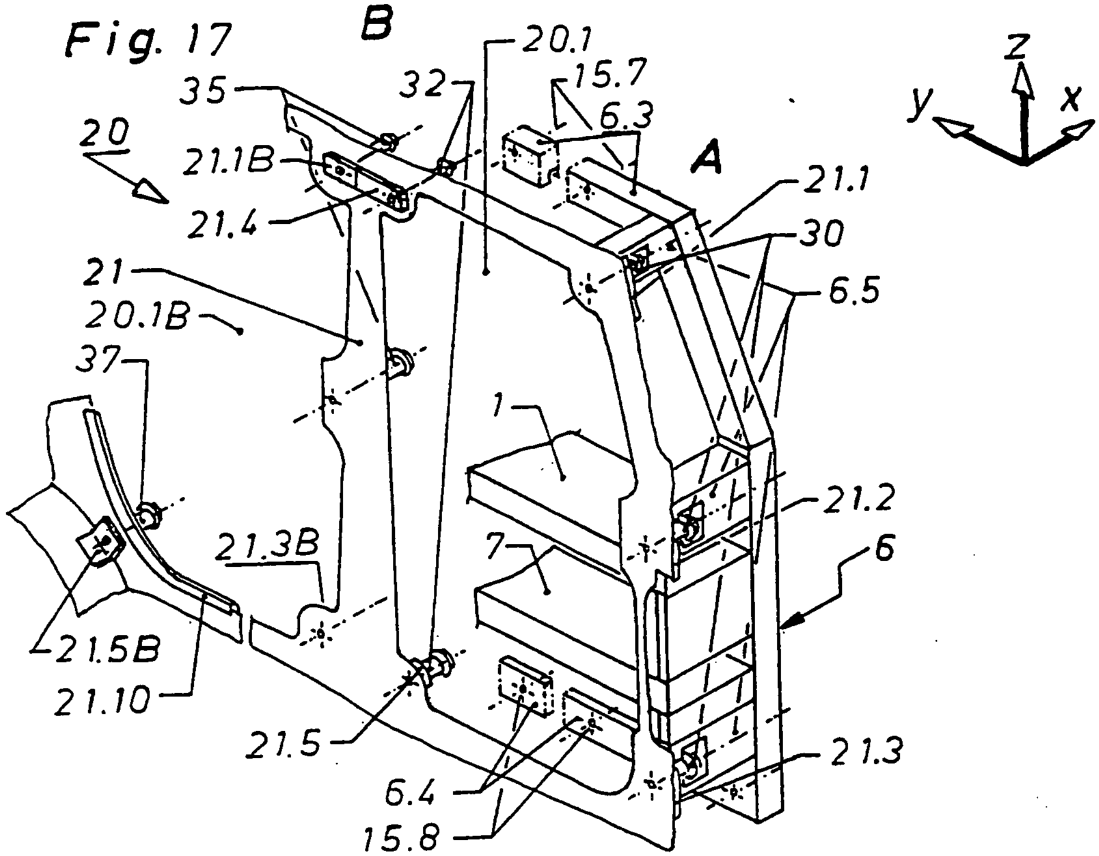
Der Präsident des Deutschen Patentamts

Norbert Haugg

Dipl.-Ing. N. Haugg

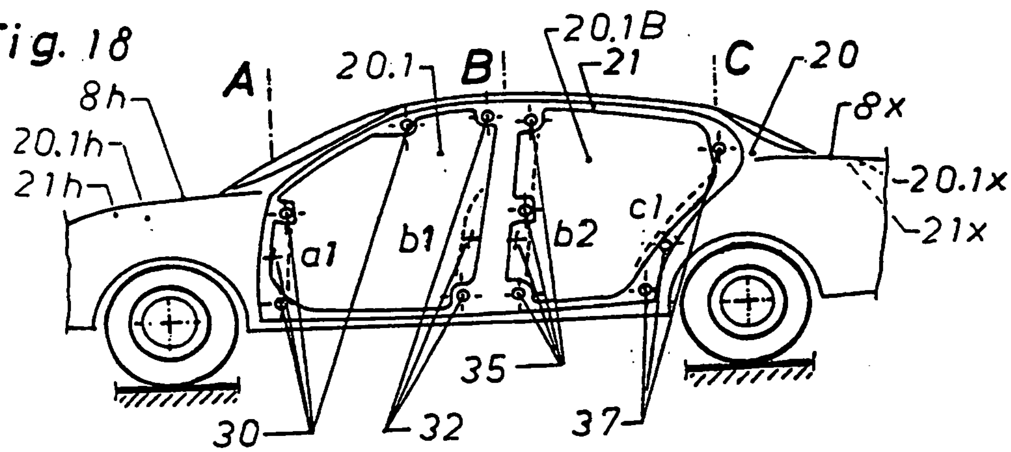
E 28

Fig. 17



No Prior Art

Fig. 18



INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part application of co-pending international application number PCT/DE 96/02120 (WO 97/18984, European Patent Doc. EP 0869878 B1) filed Nov. 7, 1996 and claiming the priority of DE 195 43 706 A1 filed Nov. 17, 1995.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all pillars (post sections or pillar portions) and the flanges of door apertures of a vehicle body thereby distributing energy to all those vehicular members, lowering stress thereof, preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) or rollover.

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*series-connected doors*"	doors of one vehicle side are series-connected
"*girder*"	panel, shell, beam etc. according to FEM and Technical Mechanics
"*window-guide channels*" of window pane (glass)	window-pane tracks **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicular members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & pillar/s, vehicle door & vehicle door in engagement in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicular members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type U2, one of four types shown in **Fig.** 13.

However, all these conventional configurations do not take into account the failure of passenger protection due to the following problem cases in conjunction with disengagement of the mating parts of interengaging assemblies from each other in the event of all types of real collision (any real collision) or real rollover:

A Load cases **I to V** according to Technical Mechanics/FEM in real front, side and rear collision;
B Wrong assumption of the prior art for the purpose of idealizing a general side energy S or S_1 to a single energy S_x or S_{x1};
C Analogy between the state of non-contact and disengagement;
D Constant, small contour-clearance and assembly tolerance zones;
E Large clearances of interengaging assemblies;
E1 The first inventions of interengaging assemblies, huge production costs and fatal injury in real collision due to large clearances;
E2 Large deformation of vehicle structure or door **8. 8B** in real collision;
E3 Large deformation of side rail **18** in real collision;
E4 Large deformation of upper member **8.17** of door frame and vehicle roof **17** in real collision;
E5 Intrusion of vehicle roof **17** in vehicle body **20** on real rollovers; and
E6 Clamping assemblies or adjustable interengaging assemblies to resolve problem case **E**.

Problem case **A**: In order to idealize an impact force $2F_1$, shown in **Fig.** 10A, imposed on a vehicle structure the following assumptions must be specified:
– let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.
Load case **I** in z-y plane in **Fig.** 5: The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all pillars, series-connected doors **8, 8B** reinforced by impact elements and interengaging assemblies of those doors and pillars, is subjected to the bending moment along the y-axis.
Load case **II** in z-x plane in **Fig.** 6: The force V exerts bending moment M_{zx} along the x-axis and rotating moment $M_y = V*b$ about the y-axis acts as torsional moment along the vehicle side.
Load case **III** in x-y plane in **Fig.** 7: The A-pillar is under load of rotating moment $M_{xy} = -H*b$. The vehicle side is subjected to bending moment M_{xy} along the y-axis and buckling force H.
Subjected to the total stress of bending moments M_{zx}, M_{xy}, M_{zy}, buckling force H and torsional moments M_z, M_y in the load cases **I to III**, the vehicle side, shown in **Fig.** 8, is deformed in real front collision.
By reversibly arranging the series-connected doors **8, 8B** the same load cases are obtained for real rear collision.

Load case **IV** in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.
Load case **V** in z-x plane in **Fig.** 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column **22**, shown in **Fig.** 10A, 13, the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in load cases **IV** and **V**.

Problem case **B**: The majority of the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases **IV** and **V** be idealized to a lateral energy S_x, shown in **Fig.** 9, or S_{x1}, shown in **Fig.** 10A, imposing on the *centre* of vehicle door, illustrated as collision type U1, shown in **Fig.** 13, despite four collision types U1 to U4 and the collision type U2 having the highest percentage of severe and fatal injuries. Nevertheless, car manufacturers and suppliers world-wide have adopted this idealized S_x or S_{x1} in inventions e.g. U.S. Pat. No. 4,307,911, U.S. Pat. No. 5,806,917, U.S. Pat. No. 5,518,290, whose shortcomings are mentioned in the following problem case **E2**.

Problem case **C**: Ref. to **Figs.** 11, 12 both end coils of compression-coil spring **19** are guided by two spring seats **19.1**. Their utmost outer nodes KN_1 and KN_{End} (not drawn) rest against both stops **19.3**, where i represents the number of coils. To survey the rolling behaviour of end coil **19** on the lower spring seat **19.1** the end coil is idealized in elements by supporting springs in reference to the nodes and by the threshold value of the distance in the "state of rolling" s < 0.1 mm. **Fig.** 12 illustrates the rolling behaviour in regard to the FEM data and test results marked with M in dependence on F_z = -790, -1000 and -3000 N:

- According to test results KN_2 to KN_5 roll on the spring seat at F_z = -790 N, but in the state of non-contact at F_z = -1000 and -3000 N.
- According to FEM data the nodes in the following states are in dependence on F_z:

F_z	State of contact	State of rolling
-100	KN_1, KN_{15}, KN_{17}	KN_1 to KN_3, KN_{10} to KN_{18}
-250	KN_1, KN_{19}, KN_{20}	KN_1, KN_{15} to KN_{23}
-1415	KN_1, KN_{17}, KN_{19}, KN_{20}, KN_{30}, KN_{31}, KN_{33}, KN_{34}	KN_1, KN_{15} to KN_{35}

The state of contact (engagement) of mating parts of interengaging assemblies, idealized by nodes of the rolling end coils and mating elements of the spring, can be transformed into the state of disengagement, when the force increases.

Problem case **D**: Recently in automotive industry, great efforts have been made to achieve (finish) a constant (uniform), small contour clearance between the outer door-contour "abcde" of vehicle door **8, 8B** and the door aperture of vehicle body **20**, shown in **Fig.** 5, in order to minimize flow noise and, particularly, to achieve sales success in co-operation with an overall impression of attractive design. In the state of assembly the contour clearance e.g. of AUDI ® vehicles is only 2.5 mm and of VW Passat ® 3.5 mm.
In order to meet the above-mentioned goal and to avoid rework or reject rate large assembly tolerances between the outer door-contour and the door aperture (opening) of vehicle body **20** must be designed.

Problem case **E**: The door lock **248**, rigidly attached to vehicle door **8**, and the striker **298**, rigidly attached to pillar illustrated as B-pillar in **Fig.** 10A of U.S. Pat. No 4,307,911 representing the prior art, is provided with locking clearances in x-, y- and z-direction, thus ensuring the state of door locking and the normal operation of vehicle door. For the purpose of preserving the constant, small contour-clearance,

- the position D_a to D_c of each key **128a to 128c**, rigidly attached to vehicle door **8**, and the position S_a to S_c of mating receptacle **158a to 158c**, rigidly attached to lower stiff panel **156** of side rail **18**;
- the position D_n of key **148**, rigidly attached to vehicle door **8**, and the position B_n of mating receptacle **198**, rigidly attached to pillar,

must be provided with position-tolerances, **larger** than locking and assembly tolerances, in x-, y- and z-direction in order to avoid

1. interference with the locking operation of door lock **248** to striker **298** when closing vehicle door **8**;
2. expensive reworking at the assembly line;
3. customer complaints due to disturbing noises associated with the small distances of overlaying coils, representing the mating parts of interengaging assemblies, denoted as $w \leq 0.2$ mm, shown in **Fig.** 11; and
4. high reject rate due to different references of coordinate system of vehicle door, finished by two to three suppliers and transported to assembly line, and of vehicle body **20**, finished at the assembly line. Huge costs are necessary to computerize design data of vehicle door and structure in data files, which must be evaluated by innovative programs to minimize those position-tolerances and reject rate, however, under the condition of the constant, small contour-clearance.

Problem case **E1**: According to the prior art the taper-formed key **148** and the mating receptacle **198** should be in engagement or form-locking connection to ensure energy-transmission from one pillar to the other.
Because receptacle **198** and striker **298** are formed together in one piece, an adjustment of receptacle **198** changes the position of striker **298** to the door lock **248** as well as the clearance therebetween, which becomes too large or small. In order to properly latch and lock the vehicle door to vehicle structure the "interengaging" assembly is provided with large tolerance zones, thus violating the condition of the aforementioned feature.
When a vehicle is laterally crashed by a truck, the key **148** can disengage from mating receptacle **198** due to large clearance so the remaining energy totally deforms the vehicle door, whose intrusion can fatally injure the driver.

According to the prior art shown in **Fig.** 1A, contour tongues **16.1** should be in engagement with contour grooves **16.2** in order to integrate vehicle door **8, 8B** into side rail **18**, vehicle roof **17** and B-pillar in side collision. Without "interengaging" assembly of the vehicle door and B-pillar, the normal operation of vehicle door would be possible if the outer door-contour "abcde" were square. Regarding the recent contour design, shown in **Figs.** 5 and 18, the line "ab" is generally curve-shaped, line "bc" of front door upwardly inclined ($\beta > 90^0$) or generally curve-shaped and line "bc" of rear door generally S-shaped, so contour grooves **16.2** would interfere with contour tongues **16.1** when closing the vehicle door. Furthermore, to sustain large impact energy it is necessary to reinforce the wide contour groove by an element which, unfortunately, can't be attached to the narrow upper member **8.17** of door frame.

According to the U.S. Pat. No. 3,819,228 a bulky "engaging" bolt rigidly attached to a stiff inner panel of vehicle door **8** projects through a hole of a stiff element attached to side rail **18** when the door is in closed position. The problem of large tolerance zones remains unresolved. Moreover, the overall stylish impression spoilt by a bulky "engaging" bolt will, doubtless, not be beneficial to sales. When stepping in or out of the vehicle body while cleaning or repairing, the person can injure himself when stumbling over this bulky bolt. When closing the door the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent.

Problem case **E2**: Under the load of force F_1, shown in **Fig.** 10A, in an approx. 30^0 inclined, offset front collision against another car the vehicle structure, totally deformed, is deflected, in great extent, in the opposite x-direction and in the y-direction thus resulting in disengagement of the catching hook **148**, rigidly attached to the impact beam **1, 1B** of driver-door, and the door lock **248** from the mating recess **198** and striker **298**, all of which

are rigidly attached to the B-pillar, respectively, in association with the reduction of the distance between the A- and B- pillar from 860 mm to 490 mm in the y-direction and the collapse of passenger protection. Later on, the remaining energy totally deforms the driver-door too. If the car rolls over, the driver would be ejected therefrom.
In a real side collision of another car into a tree, great energy totally deformed the vehicle side whose intrusion fatally injured both passengers. Obviously, the lateral force, deviating from the idealized force S_{X1}, could not force catching hook **148** to penetrate into recess **198** in order to define an "interengaging" assembly.
Both real accidents resulting in severe/fatal injuries verify the shortcomings of any patent valid only for survival chance under load of an idealized force S_{X1}, denoted by arrow A in Fig. 1 of U.S. Pat. No. 5,518,290. Taken as given, the mid region of door is secured to the B-pillar by the "interengaging" assembly in an "idealized" accident, the upper, lower member **8.17, 8.18** of door frame, the vehicle roof **17** and side rail **18** are overstressed due to lack of interengaging assemblies. Moreover, problem cases **E3 to E6** remain unresolved.

As exemplified by U.S. Pat. No. 4,676,524, a pair of vertically supporting window-guide channels, rigidly mounted in both vehicle doors **8** of a convertible car is in abutting, "engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-guide channel pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-guide channel having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.
When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

thereby totally deforming the cowl and pair of window-guide channels.
The stiffness of an open roof of a convertible car, merely supported by a pair of pillars in force-locking or free connection with one pair of small-size window-guide channels, is

- very low, thereby resulting in fatality on a real rollover thereof;
- lower than that of a rotatable, stiff rollover bar;
- far lower than that of the closed roof **17** supported by two pairs of pillars and
- substantially far lower than that of the closed roof **17** strongly supported by three pairs of reinforced pillars.

Problem case **E3**: Due to great energy in a real side collision against column **22** of a central barrier, shown in **Fig.** 10A, 13, on a highway

- **large** deformation of side rail **18** and rear section of a vehicle, opposite to x-direction, caused the disengagement of the driver's less deformed vehicle door **8** from vehicle structure and later on
- the vehicle rolled over three times across the highway and down-hill, thus totally deforming vehicle structure, doors **8**, tailgate-door **8T**, out of which both rear passengers were hurled, and, alternately, opening and closing both vehicle doors **8**, out of which both front passengers were hurled out.

Grass **70** clamped between each pillar and each vehicle door **8**, shown in **Fig.** 8, was an evidence for the alternate opening and closing of both vehicle doors **8** during the rollovers.

In a side collision of a car into a tree great energy totally deformed vehicle door **8** whose intrusion severely/fatally injured the passengers.

In a collision of another car into a hill great energy totally deformed the right side rail **18** thus resulting in the disengagement of the door lock **248** and, if provided, interengaging assemblies too and later on totally deforming vehicle structure during rollover. The driver was hurled out of this car.

Problem case **E4**: In front collision or crash test impact energy deforms, in general, upper member/s **8.17** of door frame/s outwards and vehicle roof **17** upwards, thereby creating a gap „o", shown in **Fig.** 8, and preventing front vehicle door/s **8, 8B** and/or vehicle roof **17** from transmitting energy to vehicle body **20**.
Three different states of deformation are reproduced in three crash tests, conducted by ADAC, of the German vehicles of the same type 40 % offset crashed at the same speed of 50 km/h against

- a very stiff barrier,
- a deformable barrier and
- another vehicle of the same type

because the uniform load, deformable property of two colliding masses, impact condition etc. are different. The gap „o" in three different sizes, shown in **Fig.** 8, verifies the above-mentioned thesis of non-transmission of energy.

In side collision impact energy deforms, in general, upper member/s **8.17** of door frame/s inwards thereby inflicting injuries on head.

Problem case **E5**: During the rollover of a car, impact energy totally deformed vehicle roof **17** whose intrusion severely or fatally injured both front passengers, whose heads were, definitely, crushed by falsely deployed airbags, and the remaining energy totally deformed vehicle body **20** and doors **8, 8B, 8T, 8x**.

Problem case **E6**: Responsive to problem case **E**, a clamping assembly illustrated in **Fig.** 1B comprises

- a stiff hook of stiff ledge **25.2** rigidly mounted to lower door frame **8.18** and
- a thin mating panel of a stiff plate **25.1**, rigidly attached along sill rail **18**, serving as a site of predetermined fracture.

In excess of predetermined value in real side accident, the mating parts **25.1, 25.2** of interengaging assemblies are in the state of clamping to ensure the permanent engagement of lower door frame **8.18** with sill rail **18** in order to resolve the problem of passenger ejection. Load cases **I to III, V** and problem cases **E2 to E5** remain unresolved. Furthermore, there is no space to house both mating parts **25.1, 25.2** in vehicle roof **17** and upper member **8.17** of door frame subjected to lateral load F_o in real accident. The lack of interengaging assemblies became obvious on the rollover of a sport car, which plunged seven meter downwards and crashed with vehicle roof **17** at a lower level of an underpass in Wiesbaden City thus totally deforming vehicle roof **17**, body **20** and both upper members **8.17** of door frames during rollover, where the remaining energy was transmitted through both head rests, integrated into the respective seatbacks, to the vehicle floor, thereby reducing the AIS of both passengers. AIS is an international acronym of Abbreviated Injury Severity ranging from 0 (no injury) to 6 (fatality).

Responsive to problem case **E**, adjustable and/or latching mechanisms are provided for interengaging assemblies, whose adjustable and/or latchable keys are bolted to the B- or C-pillar, facing the termini of both reinforcing beams **1, 7** or **1B, 7B**, and whose mating receptacles are arranged thereto. Both plates **5.1, 5.2** of each hinge of vehicle door are provided with a rivet serving as key and an oblong mating hole. Owing to this feature load cases **I to IV** are resolved, but load case **V** and problem cases **E3 to E5** remain unresolved.

Evidently, due to load cases **I to V** and all problem cases **B, E, E1 to E5** "interengaging" assemblies of the remaining prior art are unsuitable for the purpose of energy-transmission and distribution by means of the integration of vehicle doors **8, 8B, 8T** into the vehicle body **20**, in conjunction with five tolerance zones proposed by U.S. Pat. No. 5,297,841, U.S. Pat. No. 4,307,911 and eight tolerance zones proposed by U.S. Pat. No. 5,806,917.

None of the above-mentioned configurations offer the simplicity of the present invention in manufacturing the interengaging assemblies and ensuring the engagement therefor associated with the integration of the vehicle doors with the vehicle body in order to increase the stiffness of the vehicle structure and to prevent passengers from being hurled out of the vehicle, particularly, in the event of rollover.

SUMMARY OF THE INVENTION

Accordingly, the principle object of the present invention is to overcome the deficiencies of the prior art by providing engagement for interengaging assembly having large clearances, which are necessary in car manufacturing and door assembly, in order

- to protect passengers against ejection from the vehicle body and/or intrusion of vehicular member and
- to increase the vehicular stiffness

in the event of any collision and/or rollover. These interengaging assembly are arranged to the corresponding vehicular couples (vehicular member & mating vehicular member).

This principle and other objects of the present invention are accomplished by the following features (proposals):

- minimum tolerances by installing and adjusting the engaging keys from outside to tightly mate the receptacles thereby ensuring the connection of the doors with all vehicular members of vehicle body **20** such as pillars, vehicle roof **17**, flange **21**, a pair of side rails **18**, fastened to vehicle floor, in any collision and/or on rollover;
- interengaging assemblies with adjusting mechanisms such as holes & keys **15.1 to 15.5a, 15.7, 15.8**, hooks **15.6** & reinforcing rod **17.1d** and holes & keys **30 to 37**, shown in **Fig.** 1, 3, 3A, 4, 4A and 14 to 18;
- window-guide channels to accommodate the engaging parts;
- space-saving, inexpensive design for engaging parts;
- arrangement of interengaging assemblies of a vehicular couple in at least two operating planes thus making the strict restriction of minimum tolerances less significant;
- arrangement of an U-shaped extension member having keys in the common pillar of the series-connected vehicle doors, whose holes mate with the keys to ensure the engagement owing to constrained deformation thereof.

Despite the failure of the prior art in the event of real side collision any modification and extra design for survival chance in real collision and/or on rollover will generate costs, R&D (Research and Development) expenses and weight due to the use of other inventions.
Summary of the advantages of the present invention:

A) saving labour-time by installing and adjusting engaging parts from outside the vehicle body.
B) low reject rate.
C) space-saving, inexpensive design.

D) dissimilar operating planes or at least two operating planes for each vehicular couple to ensure the engagement of its interengaging assemblies in association with energy absorption due to load cases in three different planes. **Figs.** 14 to 18 illustrate *a single vehicular couple*: window-guide channel & B-pillar with the interengaging assemblies: keys **34** & holes in z-x plane acting as the first operating plane, however, interengaging assemblies: keys **32, 33** & holes in z-y plane acting as the second operating plane. The specification is changed from the minimum tolerances of "narrow" to permissible tolerances of "far less narrow", thus cutting costs and time associated with less adjustment work to reduce large clearances thereto. This feature of dissimilar operating planes is applicable too for both interengaging assemblies: holes & **15.1, 15.2a** and **15.2, 15.3** and **15.4a, 15.5** etc., shown in **Fig.** 3. A row of the same keys is operative in dissimilar operating planes by arranging a number of the same keys **15.1** to the generally inclined A-pillar or of keys **33** to the generally inclined B-pillar. In reference to the global xyz coordinate system the key **15.2a** & hole is operative in an inclined plane. Because the hinge bolts of the front and rear doors have an operating direction in z-axis the arrangement of interengaging assemblies: holes & keys **31, 36** to one operating plane is sufficient. However, any additional arrangement of holes & keys **30, 35** improves the engagement of vehicle mating parts and substantially decreases severe/fatal injuries in any real collision.

E) minimizing the R&D work by reducing FEM calculations, crash tests and by saving material due to the arrangement of interengaging assembly in different operating planes.

F) passenger protection for all collisions by a **single** construction, manufacturing, testing expenditure, assembly and material supply.

G) exploitation of the flange **21, 21T, 21h, 21x** of vehicle body **20** provided with sound-proofing material **21.10**, shown in **Figs.** 1, 17, 18, due to the sites to accommodate keys and the continuous stress curve. The enlargement of the flange to a limited extent neither impairs the overall stylish impression nor obstructs the passenger from ingress into or engress from the passenger compartment. Those edges (regions) of all pillars are defined by the dotted lines "a1", "b1", "b2" and "c1".

H) overall stylish impression. As substitutes of the bulky bolt ref. to U.S. Pat. No 3,819,228 small-size parts can be distributed in inconspicuous manner along the window-guide channels as well as flange, thus substantially ensuring the engagement of vehicular couple whilst lowering stress. Due to this feature it is possible to arrange the following keys:

- **30, 32, 35, 37** to the respective flange **21** of vehicle body **20**. In contrary to U.S. Pat. No. 3,819,228, this feature won't endanger passenger when stepping in or out, furthermore, more useful for passenger protection in side collision, particularly, according to collision types U1 and U2, shown in **Fig.** 13, as well as in front collision.
- **15.2a, 15.2, 15.7** e.g. with screws M4 to the narrow window-guide channel **6.3, 6.3B** of upper member **8.17** of door frame to resolve the problem of the large, stiff contour groove of the prior art.
- **33, 34, 36** to the respective window-guide channels **6, 6B** and channels **6.7, 6.8** in engagement with the reinforced B-pillar in two to three operating planes without obstructing the operation of the seat belt **26.1**, shown in **Fig.** 15. The fact, that no contact is made during the opening operation of series-connected vehicle doors, is demonstrated by the trajectories of both outer points of the washer and of the door edges drawn with dotted lines.
- **31** to the respective window-guide channels **6** and channels **6.6a** in engagement with the reinforced A-pillar.

I) less stress to solve the problem of total deformation. By means of arrangement of interengaging assemblies of each vehicular couple in multi-operating planes and increase of vehicular couples comprising vehicle door & vehicle roof **17**, vehicle door & side rail **18**, vehicle door & pillar/s and vehicle door & vehicle body **20** more vehicular members in compound construction are involved in energy absorption in different load cases in the event of any collision and/or rollover.
   In co-operation with another prior art the structural stiffness reaches the maximum. Beyond doubt, the advantage of keys *2.1, 5.6* & mating holes is due to the further exploitation of the very stiff impact beams **1, 7** to house the corresponding parts.
   Because the other vehicular couples comprising such as vehicle door & side rail and vehicle door & vehicle roof are not equipped with interengaging assemblies this *single* arrangement of one vehicular couple in mid region of door is insufficient in the event of any collision and/or rollover, therefore endangering the passengers in the following state of deformation
   - intrusion of vehicle roof **17** into the vehicle body and of upper member **8.17** of door frame, thus squashing the passengers and
   - buckling of the upper portion of the A-pillar, total deformation of upper member **8.17** of door frame, buckling of vehicle roof **17** and buckling of side rails **18**, shown in **Fig.** 8.

   In order to avoid the above-mentioned state a number of holes or keys **30 to 37** is arranged to the flange **21** *above*, *below* of the impact beams **1, 7** and *therebetween*. When the *non-adjustable* rivets *5.6* of the door hinges in x-z operating plane are replaced by a number of interengaging assemblies **15.1, 15.2a, 15.4, 30, 31** in numerous operating planes, the total stress of the vehicular couples: A-pillar & vehicle door along the z-axis is lower owing to stress distribution, thereby preventing, to a certain extent, the A-pillar and vehicle door from total deformation and gap „o", shown in **Fig.** 8.

J) measures against passenger ejection and total deformation of the vehicular members, whereby vehicle doors are not or less deformed, in real accident ref. to problem cases **E2 to E4**, which can solely be solved by engagement of the following interengaging assemblies governed by permissible tolerances:
   - holes & keys **15.3, 15.3a, 15.5a, 15.5** owing to U-shaped extension members **17.3, 18.3**, whose deformation causes a constrained deformation of the series-connected vehicle doors, vehicle roof and side rails;
   - holes & keys **32, 33, 34, 30, 15.2, 15.4a** of the vehicular couple comprising vehicle door & B-pillar in four operating planes; *and/or*
   - hooks **15.6** & reinforcing rod **17.1d** of both vehicular couples comprising series-connected vehicle doors & side rail and series-connected vehicle doors & vehicle roof, so that the deformation of the side rail and vehicle roof causes a constrained deformation of the series-connected vehicle doors; and

   by *energy transmission* into the other vehicle side by means of transverse girders **17.2, 17.2b, 17.2c, 17.2d, 18.2** of vehicle roof, side rails and all pillars facing each other, thus distributing the energy thereto.

K) passenger protection by engagement of vehicle couples in rear collision. Door detachment in rear collision occurred due to the lack of door hinges and interengaging assemblies. For the purpose of connection of vehicular members to each other the engagement of rear door **8B** with the C-pillar is improved by rigidly arranging
   - member **6.5C**, adapted to the outer door-contour and having holes to receive mating keys 37, shown in **Figs.** 14, 18, to the door frame of rear door; and
   - keys **33, 34** to window-guide channel **6B**.

The features of vehicle door are, doubtless, suitable for tailgate door **8T**, sliding side door, liftgate door cargo door, trunk cover **8x**, hood **8h**, series-connected doors, e.g. three vehicle doors with four pillars of large van.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments, other advantages and features of the present invention will be described in the accompanying drawings with reference to the xyz global coordinate system:

Fig. 1 is a side view of vehicle side, body, impact beams, keys, hooks, window-guide channels serving as reinforcing elements.

Fig. 1A is a cross-sectional view of a vehicle door engaging with a roof and side rail ref. to DE-OS 2162071 in side collision.

Fig. 1B is a cross-sectional view of a vehicle door engaging with a side rail ref. to EP 0423465 A1 in side collision.

Fig. 2 is a side view of an U-shaped window-guide channel, the position of keys **15.7, 15.8** and of an additional window-guide member **6.4, 6.4B**.

Fig. 2A is a side view of an U-shaped window-guide channel, the position of keys **15.7**.

Fig. 3 is a perspective view of a front stiff door frame with both window-guide channels, both respective window-guide channels and interengaging assemblies of the 1st embodiment.

Fig. 3A is a cross-sectional view of a key equipped with an adjusting mechanism.

Fig. 4 is a perspective view of interengaging assembly hooks & reinforcing rod of the 2nd embodiment.

Fig. 4A is a cross-sectional view of the reinforcing rod and the mating hook equipped with an adjusting mechanism.

Fig. 5 illustrates a load case I in z-y plane in front collision of vehicle.

Fig. 6 illustrates a load case II in z-x plane in front collision.

Fig. 7 illustrates a load case III in x-y plane in front collision.

Fig. 8 is a state of total deformation of vehicle at displacement v in front collision.

Fig. 9 illustrates a load case IV in x-y plane in side collision of vehicle.

Fig. 10 illustrates a load case V in z-x plane in side collision.

Fig. 10A illustrates the mating parts of interengaging assemblies ref. to U.S. Pat. No 4,307,911, both mating parts of a door lock, the general force F_1 or S_1 in the event of front or side collision and a highway column.

Fig. 11 is a view of a compression-coil spring on a lower spring seat.

Fig. 12 illustrates the projection of the end coil and spring seat in a plane, the test results and FEM data of an end coil rolling on the lower spring seat in dependence on load.

Fig. 13 illustrates four collision types U1 to U4 ref. to the research work of Institute of Vehicle Safety, a Dept. of German Insurers Association, and a highway column.

Fig. 14 is a perspective view of interengaging assemblies of the 3rd embodiment comprising a stiff front door frame having a single window-guide channel and a stiff rear door frame having a single window-guide channel to engage with the pillars and flange of vehicle body.

Fig. 15 is a cross-sectional view of the series-connected doors in engagement with the A-, B-pillar and of the vehicle body along the line D-D in **Fig.** 14.

Fig. 16 is a side view of the series-connected stiff door frames without window pane in engagement with the B-pillar according to arrow E in **Fig.** 14.

Fig. 17 is a perspective view of interengaging assemblies of the 4th embodiment comprising a stiff front door frame having a single window-guide channel in engagement with the flange of vehicle body.

Fig. 18 is a side view of the flange of vehicle body provided with keys.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Beyond doubt, the function of the interengaging assemblies is well described in the preferred embodiments of the prior art. However, the tolerances, e.g. eight tolerance zones of each interengaging assembly ref. to U.S. Pat. No. 5,806,917, are totally neglected in the scope because the explanation of how to assemble and manufacture the interengaging assemblies in relation to the **Figs.** fails. Hence, this subject must be taken into account when the function and assembly of the interengaging assemblies is described in conjunction with manufacturing parts thereof, distributing energy to the vehicular members and increasing the vehicle stiffness. When the door is closed, the interengaging assemblies in engagement can ensure the connection of the door with the vehicle body if the clearance (tolerances) between the mating parts thereof is well defined.

Ref. to **Fig.** 3 the scope of the application of the window-guide channels of vehicle door is extended to accommodate the keys of interengaging assemblies, whose mating receptacles are arranged to any (A-, B-, C- or D-) pillar, flange of vehicle body, vehicle roof and/or side rail. This feature saves weight and costs. The positions of keys and mating receptacles may be interchanged if desired.

According to the prior art a stiff door frame of vehicle door can be assembled, without door girder and reinforcing elements, from at least two impact beams provided with interengaging assemblies and at least one window-guide channel **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**. As is customary, the conventional window-guide channels **6.1, 6.2, 6.1B, 6.2B**, shown in **Figs.** 1 and 3, are made from U-shaped thin panel. The window-guide channels, serving as *reinforcing elements*, are of higher-grade tensile strength **6.1a, 6.2a, 6.1aB, 6.2aB** to:

- reinforce the conventional U-shaped window-guide channels of metal sheets,
- receive parts such as hooks, keys and/or holes and
- receive retaining members **6.5, 6.5B, 6.6a, 6, 6b, 6.7a, 6.7b, 6.8, 6.9** (not drawn) serving as structural element with higher-grade tensile strength.

The retaining members **6.8, 6.9** ref. to **Fig.** 14 are fixedly attached to the front faces of both impact beams **1B, 7B** and window-guide channel **6B**, the retaining members **6.6b, 6.7b** to window-guide channel **6** and impact beam **7** and the retaining members **6.6a, 6.7a** to window-guide channel **6** and between both impact beams **1,** 7.

Both window-guide channels are replaceable by a conventional U-shaped stiff window-guide channel **6, 6B**, shown in **Figs.** 2, 2A, 14 to 17. Less stiff window-guide members **6.3, 6.3B** are normally made of panel. Alternately, very stiff window-guide member **6.3, 6.3B** serves to receive the window pane and keys **15.7.**

Window-guide channel **6, 6B** provided with window-guide member **6.3, 6.3B** in the door cavity, shown in **Fig.** 2A, has open ends. To maximize the stiffness of window-guide channel **6, 6B** both ends are rigidly connected to each other by window-guide member **6.4, 6.4B** in the door cavity, shown in **Figs.** 2, 14 to 17:

- after the window pane has been inserted, *or*
- by having flat profile, shown in **Fig.** 17, for the purpose of receiving window pane **60, 60B**, shown in **Fig.** 15. Later on, this window pane must be secured against falling down by protective parts.

The window-guide member **6.4, 6.4B** is useful for the accommodation of keys **15.8.** If extraneous weight is not that important for heavy cars, trucks and vans, the window-guide channel, fastened to the impact beams, serves as members of door frame to receive keys while guiding and receiving the window pane.

One of the solutions for the problem case **E4** and energy-distribution to both pillars, door **8, 8B**, roof **17** and side rail **18** as well as from one vehicle side to the other vehicle side is featured in the 1st embodiment by arranging

- key **15.1** to a reinforcing element of the L-shaped A-pillar, welded to reinforcing panel **17.1c** arranged along the vehicle roof and to transverse girder **17.2d** of both facing A-pillars of both vehicle sides, and the mating oblong hole to window-guide channel **6.1a**;
- keys **15.1** to reinforced A-pillar and the mating oblong holes to window-guide channel **6.1a**;
- keys **15.2** to window-guide channels **6.1a, 6.2a** and the mating holes to reinforcing panel **17.1a** arranged along the vehicle roof; and
- keys **15.4** to the reinforcing plate of reinforcing panel **18.1** arranged along the side rail, and the mating holes to window-guide channels **6.1a, 6.2a**.

In case of large-sized door it is recommended to arrange additional keys **15.2, 15.4** to window-guide channel **6.3**, member **6.4** and the mating holes to the reinforced vehicle roof and the reinforced side rail, respectively.

Ref. to **Fig.** 4 the 2nd embodiment consists of an interengaging assembly, the hooks of which are attached to two window-guide channels of each vehicle door and the mating rod to the vehicle roof, pillars of the door or all doors. Additionally, the rod serves to reinforce the vehicle roof, sustain impact force and aid positioning on assembly, thus cutting costs and time at the assembly line. However, this embodiment needs space, which is available in large cars, trucks and vans. This embodiment is suited too for another vehicular couple comprising vehicle door/s & side rail.
The interengaging hooks **15.6** are bolted to window-guide channels **6.1a, 6.2a, 6.1aB, 6.2aB** and the mating reinforcing rod **17.1d** is arranged along the vehicle roof **17** and/or side rail **18**. When at least one pair of rods is welded to transverse girders **17.2e, 17.2f, 17.2g** of both A-, B- and C-pillars, energy can be distributed from one vehicle side to the other vehicle side in side collision, from the front to rear vehicle section of vehicle body **20** in front collision, from the rear to front vehicle section of vehicle body **20** in rear collision or to all members of vehicle body **20** on rollover.

Ref. to **Figs.** 14, 17, 18 the 3rd embodiment consists of interengaging assemblies **30 & 6.5, 35 & 6.5B** and other interengaging assemblies **32 & 6.9, 37 & 6.9B (6.9, 6.9B** similar to **6.5), 37 & 6.5C** for the purpose of avoiding large deformation of the edges of each door and of saving costs by exploiting the flange **21** of vehicle body **20** and the enlarged flange defined by the dotted lines "a1", "b1", "b2" and "c1" to receive keys. The keys **30, 32, 35, 37** are bolted to the respective reinforcing elements **21.1 to 21.5, 21.1B to 21.5B** of the flange **21** of vehicle body **20** and the corresponding holes are arranged to the housings **6.5, 6.5B** and/or auxiliary member **6.5C**, all of which are rigidly attached to the respective window-guide channels **6, 6B**, the respective elements **6.6b, 6.7b, 6.8, 6.9** (not drawn because of the similarity to **6.7b**) and/or the respective impact beams **1, 1B, 7, 7B**. The reinforcing element **21.5B** is welded to the flange and rear wheel case. The same reinforcing method can be employed to arrange a similar element **21.1** to the flange and the front wheel case.

Stiff door hinges in co-operation with impact beams **1, 7, 1B, 7B** and interengaging assemblies transmit forces of load case **I** from the front to rear vehicle section of vehicle body **20** in front collision. There is no door hinges to connect the rear door to the C-pillar. To improve energy transmission from the rear to front vehicle section of vehicle body **20** in rear collision, an auxiliary member **6.5C** is attached to the impact beams **1B, 7B**. Instead of the bulky "engaging" bolt ref. to U.S. Pat. No. 3,819,228 these keys, configured in small size and distributed along the flange, neither spoil the overall design nor injure persons stepping in or out of the vehicle body.

The Technical Mechanics Method of constrained deformation is applied to secure the engagement of all vehicular members with each other in the event of accident and to distribute impact energy thereto by means of two U-shaped extension members **17.3, 18.3**, located in common pillar ref. to **Fig.** 3, whose keys **15.3, 15.3a, 15.5, 15.5a** are engaged with the mating apertures, arranged to the corresponding window-guide channels **6.2a, 6.1aB** of series-connected doors **8, 8B**, when doors are closed. This feature of the 4th embodiment prevents the disengagement of interengaging assemblies due to large inward deflection of vehicle body **20**, vehicle roof **17** or side rail **18**, above-mentioned in the problem case **E2, E3** or **E5**, when the doors are subjected to little or no deformation. As connection element of the common pillar and the vehicle roof, this U-shaped extension member **17.3** is welded to reinforcing panel **17.1b**, arranged along vehicle roof **17**, and to transverse girder **17.2c** of both facing common pillars of the vehicle sides. As connection element of the common pillar and the vehicle floor this U-shaped extension member **18.3** is welded to reinforcing panel **18.1b**, arranged along the vehicle floor, and to transverse girder **18.2** of both facing common pillars of the vehicle sides. The belt case **26** can be housed in the U-shaped extension member **18.3**.

Due to the arc-travel path of the door about the mutual axis of door hinges the mating surfaces of key and receptacle of each interengaging assembly, proposed by U.S. Pat. No. 5,806,917, are configured in four tapered forms or two curved and two tapered forms, thus yielding eight tolerance zones, high manufacturing and assembling costs as well as making tight engagement impossible resulting in door detachment in accident. To resolve these problems straight (non-curved, non-inclined or non-tapered) engaging surfaces are proposed for key and receptacle. The purpose of assembling and adjusting any key, shown in Figs. 3, 3A, 4 and 4A, from outside of the vehicle body **20** is to substantially cut labour time and costs. Costs can be enormously lowered by using mechanical connecting parts, particularly standard parts like washer (ref. to DIN 125), hexagon socket head screw (ref. to DIN 912) etc. With the exception of **15.4a** each key **15.1** to **15.5a, 15.7, 15.8, 30** to **37** comprises a screw **15.14**, a sleeve **15.11**, a number of washers built into one spacer **15.12** and a washer with a large exterior diameter **15.13**, illustrated in **Figs.** 3A, 14 to 18. In order to ensure the engagement of key with mating hole a protrusion „x_m" and circumferential clearance „c_c", explained in the next section, must be preserved by:

- correcting the length of spacer „l" by removing or adding washers and/or
- assembling a sleeve with exterior diameter „d", washer with exterior diameter „D" and/or spacer with diameter „d_R".

If desired, the sleeve **15.11** and spacer **15.12** can be made of soundproofing material.

Each hook **15.6**, shown in **Figs.** 4 and 4A, comprises a hook **15.20** with interior diameter „d_1" and gap „s_1", smaller than „d_1", a screw **15.21**, a number of washers built into one spacer **15.22**, a coil-spring washer **15.24** and a nut **15.25.** The symbols „s_1", „d_1" and „d_2" are shown in **Fig.** 4A. In order to ensure perfect engagement of the hooks with reinforcing rod **17.1d**, having diameter „d_2" smaller than „s_1", small tolerance zones, shown in **Fig.** 4A, must be preserved by:

- assembling a hook with gap „s_1";
- assembling a rod with diameter „d_2";
- correcting the distance „l_1" by removing or adding washers; and/or
- positioning the centres of the hook hole and the reinforcing rod out of alignment.

Fig. 15 exemplifies another feature of numerous different planes, wherein the interengaging assemblies of any vehicular couple comprising e.g. the common or B-pillar and the series-connected vehicle doors **8, 8B**, operate. When the doors are closed, key **33** protrudes the mating hole by „$-x_m$" (minus sign in respect to the opposite x-direction), which is limited due to the arc-travel path of the door about the axis of door hinges. The clearances of key **33** and the mating hole are denoted by „$-y_m$" and „y_p". The protrusion „x_m", circumferential clearance „c_c" (not drawn, represented by „$-y_m$" and „y_p" in y-direction) of the mating parts of each assembly and operating plane play a significant role on tight engagement thereof in accident. In the accident, above-mentioned in the problem case **E2** or **E3**, the door becomes detached due to large circumferential clearances of all mating parts of interengaging assemblies, which operate in the same z-y plane, and large inward deflection of the vehicle body **20** or side rail **18** in the opposite x-direction, during which under the load of inertia forces of the passenger the door is opened and moved in the arc-travel path about the axis of door hinges. Door detachment can be prevented by minimum tolerances, whereby the mating parts of interengaging assemblies of any vehicular couple, acting in the same operating plane, are governed.
In this time- and cost-saving feature against door detachment, proposed for the following embodiments, many interengaging assemblies of any vehicular couple comprising e.g. interengaging assemblies keys **32, 33, 34** & mating holes, must operate in numerous different planes, where the deformation of door **8** results in a tight engagement of keys **32, 34** with the mating holes, taken, the worst case is given, that all keys **33** fail to engage with the mating holes. The interengaging assemblies, comprising keys **32, 33, 34** & mating holes, operate in three different planes, the number of which can be increased by arranging these interengaging assemblies in the planes, which, however, are offset to each other, e.g. in offset z-y planes. The interengaging assemblies keys **35** & holes act in the fourth operating z-y plane and keys **36** & holes in the fifth operating z-x plane. Owing to this feature the minimum tolerances of "narrow" are outdated, hence, replaced by permissible tolerances of "less narrow", "far less narrow", "small" and/or "medium", thus significantly lowering the reject rate, assembly time and costs. Advantageously, a pattern of the interengaging assemblies, governed by permissible tolerances, can be issued in a table handed to assembly workers. Alternately, this pattern can be coded in the assembly program to drill, position and assemble parts thereof within the permissible tolerances. The constant, small contour clearance and the proper tolerance between door lock **248** and striker **298**, above-mentioned in the problem cases **D** and **E**, can easily be accomplished at the assembly line within short time, thus making rework as well as adjustment work superfluous. It should always be reckoned with a reject when the assembly tolerances are, unexpectedly, larger than the permissible tolerances. Adjustment work for the interengaging assemblies of the rejected car can be done outside of the assembly line, thereby preserving the production process and low reject rate. All these advantages outweigh the costs of extra material for a larger number of interengaging assemblies.

A washer **15.13** with radial teeth, serving as part of key **33**, clamps in the inner region of the reinforced B-pillar in any collision or on rollover. As an integral part of a screw ref. to DIN 931 Form Z the washer won't come loose on assembly.
Costs can be cut by positioning an unadjusted key between adjustable keys, such as rivet **15.4a** ref. to DIN 660, fastened to the reinforcing plate of reinforcing panel **18.1a** arranged along the side rail. However, when the number of the interengaging assemblies is limited in a low-cost configuration, for perfect interengagement the provision with keys **15.1 to 15.8, 30 to 37** without key **15.4a** is ultimately necessary.

Large total stress of the load cases e.g. **I to III** results in total deformation (buckling) of the pillars, side rail, vehicle roof and/or doors because stress of vehicle body and doors in a real accident can never be predetermined in the research and crash tests, three of which are mentioned in the problem case **E4**, due to the collision type, the boundary conditions and properties of two masses colliding against each other. Four front collision types are shown in **Fig.** 13. In a real accident a front, side and/or rear collision can end up in a pile-up or on a rollover, thus increasing the number of collision types and making a FEM calculation impossible. To resolve such indeterminate stress the vehicular couples comprising front pillar / door **8, 8B**, rear pillar / door **8, 8B**, vehicle roof **17** / door **8, 8B** and side rail **18** / door **8, 8B** must be equipped with many interengaging assemblies operating in numerous planes, such as keys **30** & holes acting in the first operating z-y plane, keys **31** & holes acting in the second operating z-x plane, key **15.2a** & hole, shown in **Fig.** 3, acting in the third operating z-y plane and in co-operation with additional interengaging assemblies, the mating parts of which may be chosen among the keys **15.1, 15.2, 15.3, 15.3a, 15.4, 15.4a, 15.5, 15.5a, 15.6 to 15.8, 32 to 37** and mating receptacles in the above-mentioned embodiments.

Although the present invention has been described and illustrated in detail, it is clearly understood that the terminology used is intended to describe rather than limit. Many more objects, embodiments, features and variations of the present invention are possible in light of the above-mentioned teachings. Therefore, within the spirit and scope of the appended claims, the present invention may be practised otherwise than as specifically described and illustrated.

What is claimed:

1. An increased stiffness of vehicle structure comprising
a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;
a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and
adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar and
- vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

2. An increased stiffness of vehicle structure comprising
a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;
three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon;
at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and
adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle doors are closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

– vehicle door & vehicle roof **(17)**,
– vehicle door & side rail **(18)**,
– vehicle door & pillar,
– series-connected vehicle doors & common pillar and
– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

3. An increased stiffness of vehicle structure comprising
a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;
a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and
adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to permissible tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

– vehicle door & vehicle roof **(17)**,
– vehicle door & side rail **(18)**,
– vehicle door & pillar and
– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

4. An increased stiffness of vehicle structure comprising
a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;
a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

– vehicle door & vehicle roof **(17)**,
– vehicle door & side rail **(18)**,
– vehicle door & pillar and
– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

5. An increased stiffness of vehicle structure comprising

a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;

three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

– vehicle door & vehicle roof **(17)**,
– vehicle door & side rail **(18)**,
– vehicle door & pillar,
– series-connected vehicle doors & common pillar and
– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

6. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & vehicle roof **(17)** consists of

at least two hooks **(15.6)** mounted to the window-guide channels **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating rod **(17.1d)**, serving as key, arranged along that vehicle roof and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

7. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & side rail **(18)** consists of

at least two hooks **(15.6)** mounted to the window-guide channels **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating rod **(17.1d)**, serving as key, arranged along that side rail and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

8. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of series-connected vehicle doors & vehicle roof **(17)** and series-connected vehicle doors & side rail **(18)** consist of

at least eight hooks **(15.6)** mounted to the corresponding window-guide channels; and

two mating rods **(17.1d)** arranged along that vehicle roof, side rail and mounted to three transverse girders **(17.2e, 17.2f, 17.2g)**, connecting all pillars of both vehicle sides to each other.

9. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assembly of vehicle door & pillar, whereto the door hinges are fastened, consists of

a key **(15.1)** bolted to the intersection region of the pillar and roof, which is reinforced by a plate **(17.1c)** and transverse girder **(17.2d)**, connecting the pillars of both vehicle sides to each other; and

the mating hole arranged to the window-guide channel **(6.1a, 6.2a, 6.1aB, 6.2aB)** .

10. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & vehicle roof consist of

a key **(15.2a)**, bolted to an element **(6.11)** rigidly attached to the respective window-guide channel **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**, and a plurality of the keys **(15.2)**, bolted to the respective window-guide channels; and

the mating holes arranged to the vehicle roof **(17)**, reinforced by a plate **(17.1, 17.1a)** and transverse plate **(17.2a)** connecting the pillars of both vehicle sides to each other.

11. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & side rail consist of

a plurality of keys **(15.4, 15.4a)** mounted to the respective window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating holes arranged to the side rail **(18)** reinforced by an element **(18.1, 18.1a)**.

12. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & vehicle roof and vehicle door & side rail consist of

a plurality of keys **(15.2, 15.4, 15.4a)** mounted to the respective window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating holes arranged to the vehicle roof **(17)**, reinforced by the plate **(17.1a)**, and to the side rail **(18)**, reinforced by the element **(18.1, 18.1a)**.

13. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle doors & flange **(21)** of vehicle body **(20)** consist of
a plurality of keys **(30, 32, 35)** bolted to the reinforced flange **(21)** of vehicle body **(20)**; and
the mating holes arranged to the housings **(6.5, 6.5B)** rigidly attached to the window-guide channels **(6, 6B)**, retaining members **(6.6b, 6.7b, 6.8)** and impact beams **(7, 7B)**, respectively.

14. An increased stiffness of vehicle structure according to claim **1**, wherein a member **(6.5C)**, whose contour is adapted to the door-contour, is rigidly attached to the window-guide channel **(6B)** and impact beams **(1B, 7B)**.

15. An increased stiffness of vehicle structure according to claim **14**, wherein the adjustable interengaging assemblies consist of
a plurality of keys **(37)** bolted to the rear flange **(21)** of vehicle body **(20)** reinforced by an element **(21.4B, 21.6B, 21.5B)**; and
the mating holes arranged to the door-contour-shaped member **(6.5C)**.

16. An increased stiffness of vehicle structure according to claim **1**, wherein the hook **(15.6)**, adjustable from outside the vehicle, comprises a screw **(15.21)**, a number of spacers **(15.22)**, washer **(15.24)**, nut **(15.25)** and a hook with interior diameter (d_1) and gap (s_1).

17. An increased stiffness of vehicle structure according to claim **1**, wherein the key, adjustable from outside the vehicle, comprises a screw **(15.14)**, large washer **(15.13)** with outer diameter (D), a number of spacers **(15.12)** and a sleeve **(15.11)**, both have a total length (l).

18. An increased stiffness of vehicle structure according to claim **17**, wherein the sleeve **(15.11)** of the key with exterior diameter (d) is governed by the equation ($D \geq d \geq d_R$), where (D) is the exterior diameter of washer **(15.13)** and (d_R) is the diameter of spacer **(15.12)** and sleeve.

19. An increased stiffness of vehicle structure according to claim **17**, wherein the front region of washer **(15.13)** has radial teeth.

20. An increased stiffness of vehicle structure according to claim **17**, wherein the washer is an integral part of a screw.

21. An increased stiffness of vehicle structure according to claim **1**, wherein both ends of the U-shaped window-guide channel **(6, 6B)**, facing the lower vehicular member of vehicle body **(20)**, and an upper portion of that window-guide channel, facing the upper vehicular member of vehicle body **(20)**, accommodate the members of interengaging assemblies.

22. An increased stiffness of vehicle structure according to claim **21**, wherein both ends of the respective stiff U-shaped window-guide channel **(6, 6B)** are connected to each other by a window-guide member **(6.4, 6.4B)**.

23. An increased stiffness of vehicle structure according to claim **1**, wherein the window-guide channels **(6.1, 6.2, 6.1B, 6.2B)** are rigidly attached to the respective stiff window-guide members **(6.1a, 6.2a, 6.1aB, 6.2aB)**.

24. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & pillar, whereto the vehicle door hinges are fastened, consist of
a plurality of keys **(31, 36)** bolted to a retaining member **(6.6a, 6.8)**, rigidly attached to the window-guide channel **(6, 6B)**, and impact beams **(1, 1B, 7, 7B)**; and
the mating holes arranged to the pillar reinforced by an extension member **(23)** and adjacent to that window-guide channel.

25. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by
at least one pair of keys **(15.3, 15.3a)** bolted to both legs of extension member **(17.3)**, mounted to the common pillar, reinforced by a plate **(17.1b)**, arranged along the vehicle roof **(17)** and attached rigidly to a transverse girder **(17.2c)**, connecting the common pillars of both vehicle sides to each other; and
the mating holes arranged to both window-guide channels of series-connected vehicle doors adjacent to that common pillar.

26. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by
at least one pair of keys **(15.5, 15.5a)** bolted to both legs of extension member **(18.3)** mounted to the common pillar, reinforced by an element **(18.1b)**, arranged along the side rail **(18)** and attached rigidly to a transverse girder **(18.2)**, connecting the common pillars of both vehicle sides to each other; and
the mating holes arranged to both window-guide channels of series-connected vehicle doors adjacent to that common pillar.

27. An increased stiffness of vehicle structure according to claim **26**, wherein a belt case **(26)** is accommodated in the extension member **(18.3)**.

28. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8)** & pillar, operating in two planes, are defined by
a plurality of keys **(33)** bolted to the window-guide channel and a plurality of keys **(34)**, bolted to a retaining members **(6.7a)**, rigidly attached to the window-guide channel **(6)** and impact beams **(1, 7)**; and
the mating receptacles arranged to the reinforced pillar.

29. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & pillar, operating in three planes, are defined by
a plurality of keys **(15.1)** rigidly arranged to the reinforced pillar, whereto the door frame is hingedly secured, and a plurality of keys **(30, 31, 35, 36)**, rigidly arranged to the reinforced flange of vehicle body **(20)**; and
the mating receptacles arranged to the window-guide channel **(6.1a, 6.2a)**, retaining members **(6.6a, 6.8)** and housings **(6.5, 6.5B)**, respectively.

30. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & side rail **(18)**, operating in three planes, are defined by

a plurality of keys **(15.4a)** rigidly arranged to the side rail **(18)** and at least two keys **(30, 32, 35, 37)**, rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and

the mating receptacles arranged to the window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**, door-contour-shaped member **(6.5C)** and housings **(6.5, 6.5B)**, respectively.

31. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of vehicle door **(8, 8B)** & vehicle roof **(17)**, operating in four planes, are defined by

a plurality of keys **(15.2, 15.2a)** rigidly arranged to the respective window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)** and at least two keys **(30, 32, 35, 37)**, rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and

the mating receptacles arranged to the reinforced vehicle roof **(17)** and that window-guide channels, respectively.

32. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of connecting vehicular couples, operating in multi-planes, are defined by

a plurality of keys **(15.1 to 15.7, 30, 32, 35, 37)** rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and

the mating receptacles arranged to the reinforced portions of vehicle doors, respectively.

33. An increased stiffness of vehicle structure according to claim **5**, wherein the interengaging assemblies of series-connected vehicle doors & common pillar, operating in multi-planes, are defined by

a plurality of keys **(15.3, 15.3a, 15.5, 15.5a)** rigidly arranged to the extension members **(17.3, 18.3, 23)** of the common pillar and a plurality of keys **(33, 34, 36)**, rigidly arranged to the reinforced portions of series-connected vehicle doors, respectively; and

the mating receptacles arranged to the reinforced portions of series-connected vehicle doors and the reinforced common pillar, respectively.

34. An increased stiffness of vehicle structure, characterised by use of metal, compound material, glass fibre reinforced material or non-metal material for material of the engaging key, receptacle, window-guide channel, transverse girder, rod, plate and extension member.

ABSTRACT

On closing the door, that is conventionally hinged to the vehicle body, keys of interengagable assemblies smoothly engage with mating receptacles located on both pillars, the vehicle roof and side rail. The smooth interengagement is ensured by the adjusting mechanisms of the keys, located on the front, rear, upper and lower reinforced portion of the door, to reduce large clearances between them and their receptacles to minimum tolerances. In an accident the door tightly mates with the door-aperture of vehicle body whereby energy is distributed to the integrated vehicle body.

In the second feature of invention, the interengagable assemblies of a vehicular couple, consisting of the portion of the door and a member of the vehicle body, are arranged in at least two operating planes.

In the third feature, the deformation of the series-connected doors and their common pillar is constrained in an accident owing to an extension member, rigidly attached to the common pillar, accommodating the keys, which tightly mate with the receptacles located on the rear portion of the front door and the front portion of the rear door.

In the fourth and fifth feature, the interengagable assemblies of the vehicular couple are arranged in multi-operating planes thus cutting costs associated with less adjusting work to reduce large clearances to small tolerances.

This inventive technology is applicable for other door-types such as tailgate-, sliding side-, cargo-, liftgate door, trunk cover and hood to define a substantially stiffer vehicle body whereby stress is enormously decreased in an accident.

What is claimed:

1. An increased stiffness of vehicle structure comprising
a main vehicle body having at least one door aperture therein;
a mating vehicle door, generally representing a tailgate-, sliding side-, cargo-, liftgate door, trunk cover, hood or vehicle door, whose door frame, reinforced by at least two impact beams, spanning the door aperture, elements and at least one window-guide channel to guide and receive a window pane, is hingedly secured to that vehicle body for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and
adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of
- vehicle door & vehicle roof,
- vehicle door & side rail,
- vehicle door & pillar and
- vehicle door & flange of vehicle body

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

2. An increased stiffness of vehicle structure comprising
a main vehicle body having at least three door apertures, two of which are series-connected, therein;
three mating vehicle doors, each of which generally representing a tailgate-, sliding side-, cargo-, liftgate door, trunk cover, hood or vehicle door, whose door frame, reinforced by at least two impact beams, spanning the door aperture, elements and at least one window-guide channel to guide and receive a window pane, is hingedly secured to that vehicle body for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon;
at least one extension member, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and
adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle doors are closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof,
- vehicle door & side rail,
- vehicle door & pillar,
- series-connected vehicle doors & common pillar and
- vehicle door & flange of vehicle body

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

3. An increased stiffness of vehicle structure comprising
a main vehicle body having at least one door aperture therein;
a mating vehicle door, generally representing a tailgate-, sliding side-, cargo-, liftgate door, trunk cover, hood or vehicle door, whose door frame, reinforced by at least two impact beams, spanning the door aperture, elements and at least one window-guide channel to guide and receive a window pane, is hingedly secured to that vehicle body for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and
adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to permissible tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof,
- vehicle door & side rail,
- vehicle door & pillar and
- vehicle door & flange of vehicle body

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

4. An increased stiffness of vehicle structure comprising
a main vehicle body having at least one door aperture therein;
a mating vehicle door, generally representing a tailgate-, sliding side-, cargo-, liftgate door, trunk cover, hood or vehicle door, whose door frame, reinforced by at least two impact beams, spanning the door aperture, elements and at least one window-guide channel to guide and receive a window pane, is hingedly secured to that vehicle body for pivotal movement between an open and a closed position;
interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof,
- vehicle door & side rail,
- vehicle door & pillar and
- vehicle door & flange of vehicle body

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

5. An increased stiffness of vehicle structure comprising

a main vehicle body having at least three door apertures, two of which are series-connected, therein;

three mating vehicle doors, each of which generally representing a tailgate-, sliding side-, cargo-, liftgate door, trunk cover, hood or vehicle door, whose door frame, reinforced by at least two impact beams, spanning the door aperture, elements and at least one window-guide channel to guide and receive a window pane, is hingedly secured to that vehicle body for pivotal movement between an open and a closed position;

at least one extension member, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof,
- vehicle door & side rail,
- vehicle door & pillar,
- series-connected vehicle doors & common pillar and
- vehicle door & flange of vehicle body

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

6. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assembly of vehicle door & vehicle roof consists of

at least two hooks mounted to the window-guide channels; and

the mating rod, serving as key, arranged along that vehicle roof and mounted to two transverse girders connecting the pillars of both vehicle sides to each other.

7. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & side rail consists of
at least two hooks mounted to the window-guide channels; and
the mating rod, serving as key, arranged along that side rail and mounted to two transverse girders connecting the pillars of both vehicle sides to each other.

8. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of series-connected vehicle doors & vehicle roof and series-connected vehicle doors & side rail consist of
at least eight hooks mounted to the corresponding window-guide channels; and
two mating rods arranged along that vehicle roof, side rail and mounted to three transverse girders, connecting all pillars of both vehicle sides to each other.

9. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assembly of vehicle door & pillar, whereto the door hinges are fastened, consists of
a key bolted to the intersection region of the pillar and roof, which is reinforced by a plate and transverse girder, connecting the pillars of both vehicle sides to each other; and
the mating hole arranged to the window-guide channel.

10. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & vehicle roof consist of
a key, bolted to an element rigidly attached to the respective window-guide channel, and a plurality of the keys, bolted to the respective window-guide channels; and
the mating holes arranged to the vehicle roof, reinforced by a plate and transverse plate connecting the pillars of both vehicle sides to each other.

11. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & side rail consist of
a plurality of keys mounted to the respective window-guide channels; and
the mating holes arranged to the side rail reinforced by an element.

12. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & vehicle roof and vehicle door & side rail consist of
a plurality of keys mounted to the respective window-guide channels; and
the mating holes arranged to the vehicle roof, reinforced by the plate, and to the side rail, reinforced by the element.

13. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle doors & flange of vehicle body consist of
a plurality of keys bolted to the reinforced flange of vehicle body; and
the mating holes arranged to the housings rigidly attached to the window-guide channels, retaining members and impact beams, respectively.

14. An increased stiffness of vehicle structure according to claim **1**, wherein a member, whose contour is adapted to the door-contour, is rigidly attached to the window-guide channel and impact beams.

15. An increased stiffness of vehicle structure according to claim **14**, wherein the adjustable interengaging assemblies consist of
a plurality of keys bolted to the rear flange of vehicle body reinforced by an element; and
the mating holes arranged to the door-contour-shaped member.

16. An increased stiffness of vehicle structure according to claim **1**, wherein the hook, adjustable from outside the vehicle, comprises a screw, a number of spacers, washer, nut and a hook with interior diameter (d_1) and gap (s_1).

17. An increased stiffness of vehicle structure according to claim **1**, wherein the key, adjustable from outside the vehicle, comprises a screw, large washer with outer diameter (D), a number of spacers and a sleeve, both have a total length (l).

18. An increased stiffness of vehicle structure according to claim **17**, wherein the sleeve of the key with exterior diameter (d) is governed by the equation ($D \geq d \geq d_R$), where (D) is the exterior diameter of washer and (d_R) is the diameter of spacer and sleeve.

19. An increased stiffness of vehicle structure according to claim **17**, wherein the front region of washer has radial teeth.

20. An increased stiffness of vehicle structure according to claim **17**, wherein the washer is an integral part of a screw.

21. An increased stiffness of vehicle structure according to claim **1**, wherein both ends of the U-shaped window-guide channel, facing the lower vehicular member of vehicle body, and an upper portion of that window-guide channel, facing the upper vehicular member of vehicle body, accommodate the members of interengaging assemblies.

22. An increased stiffness of vehicle structure according to claim **21**, wherein both ends of the respective stiff U-shaped window-guide channel are connected to each other by a window-guide member.

23. An increased stiffness of vehicle structure according to claim **1**, wherein the window-guide channels are rigidly attached to the respective stiff window-guide members.

24. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & pillar, whereto the vehicle door hinges are fastened, consist of

a plurality of keys bolted to a retaining member, rigidly attached to the window-guide channel, and impact beams; and

the mating holes arranged to the pillar reinforced by an extension member and adjacent to that window-guide channel.

25. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

at least one pair of keys bolted to both legs of extension member, mounted to the common pillar, reinforced by a plate, arranged along the vehicle roof and attached rigidly to a transverse girder, connecting the common pillars of both vehicle sides to each other; and

the mating holes arranged to both window-guide channels of series-connected vehicle doors adjacent to that common pillar.

26. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

at least one pair of keys bolted to both legs of extension member mounted to the common pillar, reinforced by an element, arranged along the side rail and attached rigidly to a transverse girder, connecting the common pillars of both vehicle sides to each other; and

the mating holes arranged to both window-guide channels of series-connected vehicle doors adjacent to that common pillar.

27. An increased stiffness of vehicle structure according to claim **26**, wherein a belt case is accommodated in the extension member.

28. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door & pillar, operating in two planes, are defined by

a plurality of keys bolted to the window-guide channel and a plurality of keys, bolted to a retaining members, rigidly attached to the window-guide channel and impact beams; and

the mating receptacles arranged to the reinforced pillar.

29. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door & pillar, operating in three planes, are defined by

a plurality of keys rigidly arranged to the reinforced pillar, whereto the door frame is hingedly secured, and a plurality of keys, rigidly arranged to the reinforced flange of vehicle body; and

the mating receptacles arranged to the window-guide channel, retaining members and housings, respectively.

30. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door & side rail, operating in three planes, are defined by

a plurality of keys rigidly arranged to the side rail and at least two keys, rigidly arranged to the reinforced flange of vehicle body; and

the mating receptacles arranged to the window-guide channels, door-contour-shaped member and housings, respectively.

31. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of vehicle door & vehicle roof, operating in four planes, are defined by

a plurality of keys rigidly arranged to the respective window-guide channels and at least two keys, rigidly arranged to the reinforced flange of vehicle body; and

the mating receptacles arranged to the reinforced vehicle roof and that window-guide channels, respectively.

32. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of connecting vehicular couples, operating in multi-planes, are defined by

a plurality of keys rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and

the mating receptacles arranged to the reinforced portions of vehicle doors, respectively.

33. An increased stiffness of vehicle structure according to claim **5**, wherein the interengaging assemblies of series-connected vehicle doors & common pillar, operating in multi-planes, are defined by

a plurality of keys rigidly arranged to the extension members of the common pillar and a plurality of keys, rigidly arranged to the reinforced portions of series-connected vehicle doors, respectively; and

the mating receptacles arranged to the reinforced portions of series-connected vehicle doors and the reinforced common pillar, respectively.

34. An increased stiffness of vehicle structure, characterised by use of metal, compound material, glass fibre reinforced material or non-metal material for material of the engaging key, receptacle, window-guide channel, transverse girder, rod, plate and extension member.

What is claimed:

1. An increased stiffness of vehicle structure comprising

a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and

adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar and
- vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

2. An increased stiffness of vehicle structure comprising

a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;

three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon;

at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle doors are closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar,

– series-connected vehicle doors & common pillar and

– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

3. An increased stiffness of vehicle structure comprising

a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and

adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to permissible tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

– vehicle door & vehicle roof **(17)**,

– vehicle door & side rail **(18)**,

– vehicle door & pillar and

– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

4. An increased stiffness of vehicle structure comprising

a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

– vehicle door & vehicle roof **(17)**,

– vehicle door & side rail **(18)**,

– vehicle door & pillar and

– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

5. An increased stiffness of vehicle structure comprising

a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;

three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar,
- series-connected vehicle doors & common pillar and

– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

6. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & vehicle roof **(17)** consists of

at least two hooks **(15.6)** mounted to the window-guide channels **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating rod **(17.1d)**, serving as key, arranged along that vehicle roof and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

7. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & side rail **(18)** consists of

at least two hooks **(15.6)** mounted to the window-guide channels **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating rod **(17.1d)**, serving as key, arranged along that side rail and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

8. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of series-connected vehicle doors & vehicle roof **(17)** and series-connected vehicle doors & side rail **(18)** consist of

at least eight hooks **(15.6)** mounted to the corresponding window-guide channels; and

two mating rods **(17.1d)** arranged along that vehicle roof, side rail and mounted to three transverse girders **(17.2e, 17.2f, 17.2g)**, connecting all pillars of both vehicle sides to each other.

9. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assembly of vehicle door & pillar, whereto the door hinges are fastened, consists of

a key **(15.1)** bolted to the intersection region of the pillar and roof, which is reinforced by a plate **(17.1c)** and transverse girder **(17.2d)**, connecting the pillars of both vehicle sides to each other; and

the mating hole arranged to the window-guide channel **(6.1a, 6.2a, 6.1aB, 6.2aB)** .

10. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & vehicle roof consist of

a key **(15.2a)**, bolted to an element **(6.11)** rigidly attached to the respective window-guide channel **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**, and a plurality of the keys **(15.2)**, bolted to the respective window-guide channels; and

the mating holes arranged to the vehicle roof **(17)**, reinforced by a plate **(17.1, 17.1a)** and transverse plate **(17.2a)** connecting the pillars of both vehicle sides to each other.

11. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & side rail consist of

a plurality of keys **(15.4, 15.4a)** mounted to the respective window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating holes arranged to the side rail **(18)** reinforced by an element **(18.1, 18.1a)**.

12. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & vehicle roof and vehicle door & side rail consist of

a plurality of keys **(15.2, 15.4, 15.4a)** mounted to the respective window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**; and

the mating holes arranged to the vehicle roof **(17)**, reinforced by the plate **(17.1a)**, and to the side rail **(18)**, reinforced by the element **(18.1, 18.1a)**.

13. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle doors & flange **(21)** of vehicle body **(20)** consist of

a plurality of keys **(30, 32, 35)** bolted to the reinforced flange **(21)** of vehicle body **(20)**; and

the mating holes arranged to the housings **(6.5, 6.5B)** rigidly attached to the window-guide channels **(6, 6B)**, retaining members **(6.6b, 6.7b, 6.8)** and impact beams **(7, 7B)**, respectively.

14. An increased stiffness of vehicle structure according to claim **1**, wherein a member **(6.5C)**, whose contour is adapted to the door-contour, is rigidly attached to the window-guide channel **(6B)** and impact beams **(1B, 7B)**.

15. An increased stiffness of vehicle structure according to claim **14**, wherein the adjustable interengaging assemblies consist of

a plurality of keys **(37)** bolted to the rear flange **(21)** of vehicle body **(20)** reinforced by an element **(21.4B, 21.6B, 21.5B)**; and

the mating holes arranged to the door-contour-shaped member **(6.5C)**.

16. An increased stiffness of vehicle structure according to claim **1**, wherein the hook **(15.6)**, adjustable from outside the vehicle, comprises a screw **(15.21)**, a number of spacers **(15.22)**, washer **(15.24)**, nut **(15.25)** and a hook with interior diameter (d_1) and gap (s_1).

17. An increased stiffness of vehicle structure according to claim **1**, wherein the key, adjustable from outside the vehicle, comprises a screw **(15.14)**, large washer **(15.13)** with outer diameter (D), a number of spacers **(15.12)** and a sleeve **(15.11)**, both have a total length (l).

18. An increased stiffness of vehicle structure according to claim **17**, wherein the sleeve **(15.11)** of the key with exterior diameter (d) is governed by the equation ($D \geq d \geq d_R$), where (D) is the exterior diameter of washer **(15.13)** and (d_R) is the diameter of spacer **(15.12)** and sleeve.

19. An increased stiffness of vehicle structure according to claim **17**, wherein the front region of washer **(15.13)** has radial teeth.

20. An increased stiffness of vehicle structure according to claim **17**, wherein the washer is an integral part of a screw.

21. An increased stiffness of vehicle structure according to claim **1**, wherein both ends of the U-shaped window-guide channel **(6, 6B)**, facing the lower vehicular member of vehicle body **(20)**, and an upper portion of that window-guide channel, facing the upper vehicular member of vehicle body **(20)**, accommodate the members of interengaging assemblies.

22. An increased stiffness of vehicle structure according to claim **21**, wherein both ends of the respective stiff U-shaped window-guide channel **(6, 6B)** are connected to each other by a window-guide member **(6.4, 6.4B)**.

23. An increased stiffness of vehicle structure according to claim **1**, wherein the window-guide channels **(6.1, 6.2, 6.1B, 6.2B)** are rigidly attached to the respective stiff window-guide members **(6.1a, 6.2a, 6.1aB, 6.2aB)**.

24. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & pillar, whereto the vehicle door hinges are fastened, consist of

a plurality of keys **(31, 36)** bolted to a retaining member **(6.6a, 6.8)**, rigidly attached to the window-guide channel **(6, 6B)**, and impact beams **(1, 1B, 7, 7B)**; and

the mating holes arranged to the pillar reinforced by an extension member **(23)** and adjacent to that window-guide channel.

25. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

at least one pair of keys **(15.3, 15.3a)** bolted to both legs of extension member **(17.3)**, mounted to the common pillar, reinforced by a plate **(17.1b)**, arranged along the vehicle roof **(17)** and attached rigidly to a transverse girder **(17.2c)**, connecting the common pillars of both vehicle sides to each other; and

the mating holes arranged to both window-guide channels of series-connected vehicle doors adjacent to that common pillar.

26. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

at least one pair of keys **(15.5, 15.5a)** bolted to both legs of extension member **(18.3)** mounted to the common pillar, reinforced by an element **(18.1b)**, arranged along the side rail **(18)** and attached rigidly to a transverse girder **(18.2)**, connecting the common pillars of both vehicle sides to each other; and

the mating holes arranged to both window-guide channels of series-connected vehicle doors adjacent to that common pillar.

27. An increased stiffness of vehicle structure according to claim **26**, wherein a belt case **(26)** is accommodated in the extension member **(18.3)**.

28. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8)** & pillar, operating in two planes, are defined by

a plurality of keys **(33)** bolted to the window-guide channel and a plurality of keys **(34)**, bolted to a retaining members **(6.7a)**, rigidly attached to the window-guide channel **(6)** and impact beams **(1, 7)**; and

the mating receptacles arranged to the reinforced pillar.

29. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & pillar, operating in three planes, are defined by

a plurality of keys **(15.1)** rigidly arranged to the reinforced pillar, whereto the door frame is hingedly secured, and a plurality of keys **(30, 31, 35, 36)**, rigidly arranged to the reinforced flange of vehicle body **(20)**; and

the mating receptacles arranged to the window-guide channel **(6.1a, 6.2a)**, retaining members **(6.6a, 6.8)** and housings **(6.5, 6.5B)**, respectively.

30. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & side rail **(18)**, operating in three planes, are defined by

a plurality of keys **(15.4a)** rigidly arranged to the side rail **(18)** and at least two keys **(30, 32, 35, 37)**, rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and

the mating receptacles arranged to the window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**, door-contour-shaped member **(6.5C)** and housings **(6.5, 6.5B)**, respectively.

31. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of vehicle door **(8, 8B)** & vehicle roof **(17)**, operating in four planes, are defined by

a plurality of keys **(15.2, 15.2a)** rigidly arranged to the respective window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)** and at least two keys **(30, 32, 35, 37)**, rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and

the mating receptacles arranged to the reinforced vehicle roof **(17)** and that window-guide channels, respectively.

32. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of connecting vehicular couples, operating in multi-planes, are defined by

a plurality of keys **(15.1 to 15.7, 30, 32, 35, 37)** rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and

the mating receptacles arranged to the reinforced portions of vehicle doors, respectively.

33. An increased stiffness of vehicle structure according to claim **5**, wherein the interengaging assemblies of series-connected vehicle doors & common pillar, operating in multi-planes, are defined by

a plurality of keys **(15.3, 15.3a, 15.5, 15.5a)** rigidly arranged to the extension members **(17.3, 18.3, 23)** of the common pillar and a plurality of keys **(33, 34, 36)**, rigidly arranged to the reinforced portions of series-connected vehicle doors, respectively; and

the mating receptacles arranged to the reinforced portions of series-connected vehicle doors and the reinforced common pillar, respectively.

34. An increased stiffness of vehicle structure, characterised by use of metal, compound material, glass fibre reinforced material or non-metal material for material of the engaging key, receptacle, window-guide channel, transverse girder, rod, plate and extension member.

Office Action Summary

Application No.	Applicant(s)
08/860,182	Go

Examiner	Group Art Unit
Jason Morrow	3612

JUN 20 2000

☐ Responsive to communication(s) filed on ______

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-34* is/are pending in the application.

Of the above, claim(s) ______ is/are withdrawr from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) *1 and 2* is/are rejected.

☒ Claim(s) *3-34* is/are objected to.

☐ Claims ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on ______ is ☐approved ☐disapproved.

☒ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☒ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- *SEE OFFICE ACTION ON THE FOLLOWING PAGES* ---

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Germany on November 7, 1996. It is noted, however, that applicant has not filed a certified copy of the German application as required by 35 U.S.C. 119(b).

Drawings

2. Figures 1A, 1B, 2, 2A, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 18 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). The designations should NOT include the German equivalent label to "Prior Art".

Specification

3. The abstract of the disclosure is objected to because it is not narrative in nature and it refers to the speculative merits of the invention. Correction is required. See MPEP § 608.01(b).

4. Applicant is advised on how to arrange the content of the specification.

Content of Specification

(a) Title of the Invention: See 37 CFR 1.72(a). The title of the invention should be placed at the top of the first page of the specification. It should be brief but technically accurate and descriptive, preferably from two to seven words.

(b) Cross-References to Related Applications: See 37 CFR 1.78 and MPEP § 201.11.

(c) Statement Regarding Federally Sponsored Research and Development: See MPEP § 310.

(d) Reference to a "Microfiche Appendix": See 37CFR 1.96© and MPEP § 608.05. The total number of microfiche and the total number frames should be specified.

(e) Background of the Invention: The specification should set forth the Background of the Invention in two parts:

(1) Field of the Invention: A statement of the field of art to which the invention pertains. This statement may include a paraphrasing of the applicable U.S. patent classification definitions of the subject matter of the claimed invention. This item may also be titled "Technical Field."

(2) Description of the Related Art: A description of the related art known to the applicant and including, if applicable, references to specific related art and problems involved in the prior art which are solved by the applicant's invention. This item may also be titled "Background Art."

(f) Brief Summary of the Invention: A brief summary or general statement of the invention as set forth in 37 CFR 1.73. The summary is separate and distinct from the abstract and is directed toward the invention rather than the disclosure as a whole. The summary may point out the advantages of the invention or how it solves problems previously existent in the prior art (and preferably indicated in the Background of the Invention). In chemical cases it should point out in general terms the utility of the invention. If possible, the nature and gist of the invention or the inventive concept should be set forth. Objects of the invention should be treated briefly and only to the extent that they contribute to an understanding of the invention.

(g) Brief Description of the Several Views of the Drawing(s): A reference to and brief description of the drawing(s) as set forth in 37 CFR 1.74.

(h) Detailed Description of the Invention: A description of the preferred embodiment(s) of the invention as required in 37 CFR 1.71. The description should be as short and specific as is necessary to describe the invention adequately and accurately. This item may also be titled "Best Mode for Carrying Out the Invention." Where elements or groups of elements, compounds, and processes, which are conventional and generally widely known in the field of the invention

described and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art, they should not be described in detail. However, where particularly complicated subject matter is involved or where the elements, compounds, or processes may not be commonly or widely known in the field, the specification should refer to another patent or readily available publication which adequately describes the subject matter.

(I) Claim or Claims: See 37 CFR 1.75 and MPEP § 608.01(m). The claim or claims must commence on separate sheet. (37 CFR 1.52(b)). Where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation. There may be plural indentations to further segregate subcombinations or related steps.

(j) Abstract of the Disclosure: A brief narrative of the disclosure as a whole in a single paragraph of 250 words or less on a separate sheet following the claims.

(k) Drawings: See 37 CFR 1.81, 1.83-1.85, and MPEP § 608.02.

(l) Sequence Listing: See 37 CFR 1.821-1.825.

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of 37 CFR 1.71(a)-(c):

(a) The specification must include a written description of the invention or discovery and of the manner and process of making and using the same, and is required to be in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which the invention or discovery appertains, or with which it is most nearly connected, to make and use the same.

(b) The specification must set forth the precise invention for which a patent is solicited, in such manner as to distinguish it from other inventions and from what is old. It must describe completely a specific embodiment of the process, machine, manufacture, composition of matter or improvement invented, and must explain the mode of operation or principle whenever applicable. The best mode contemplated by the inventor of carrying out his invention must be set forth.

> © In the case of an improvement, the specification must particularly point out the part or parts of the process, machine, manufacture, or composition of matter to which the improvement relates, and the description should be confined to the specific improvement and to such parts as necessarily cooperate with it or as may be necessary to a complete understanding or description of it.

The specification is objected to under 37 CFR 1.71 because it fails to provide an adequate description of the invention. The *Description of the Preferred Embodiments* should include more than a simple listing of the parts present in each embodiment. This section should also point out the how the parts of the invention function during use. ***See the cited U.S. patents as examples of disclosures with correct form.***

6. If applicant continues to prosecute the application, revision of the specification and claims to present the application in proper form is required. While an application can be amended to make it clearly understandable, no subject matter can be added that was not disclosed in the application as originally filed.

Claim Objections

7. The claims are objected to because the lines are crowded too closely together, making reading and entry of amendments difficult. Substitute claims with lines one and one-half or double spaced on good quality paper are required. See 37 CFR 1.52(b).

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The following terms or phrases are inferentially recited in the claims:

In claim 1:

-line 6, the "supporting door frame".

-line 14, the "compound assemblies".

In claim 2:

-lines 1 and 2, the " vehicle part of vehicle body".

-line 3, the "post sections".

In claim 3:

-line 2 of claim 3, the "vehicle part".

In claim 4:

-line 2, the "vehicle part".

In claim 6:

-line 3, the "interlocking holes".

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block".

-line 6, the "mutual post section".

In claim 7:

-line 3, the "interlocking holes".

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block".

-line 7, the "side rail".

In claim 8:

-line 2, the "U-shaped block".

In claim 9:

-line 2, the "interlocking holes & interlocking blocks"

-line 3, the "post section".

-

In claim 10:

-lines 5 and 6, the "post section".

-line 6, the "reinforcing panel".

-line 7, the "side rail".

In claims 12 and 13:

-line 3, "interlocking holes".

-line 3, the "reinforcing panels".

-line 5, the "interlocking mating blocks".

In claim 14:

-line 3, the "interlocking blocks".

-line 3, the "reinforcing peripheral edges".

-line 5, the "interlocking mating holes".

In claim 15:

-line 3, the "interlocking block".

-line 4, the "top peripheral edge".

-line 5, the "interlocking mating holes".

In claim 16:

-line 4, the "bottom peripheral edge".

-line 3, the "interlocking block".

In claim 17:

-line 3, the "interlocking block".

-lines 3 and 4, the "post-section peripheral edge".

-line 5, the "interlocking mating hole".

-line 5, the "auxiliary part".

In claim 19:

- line 3, the "interlocking block".

-line 4, the "post-section peripheral edge".

-line 5, the "interlocking mating hole".

-line 5, the "outer door-contour-shaped auxiliary part".

In claim 20:

-line 5, the "post section".

In claim 21:

-line 2, the "post section".

-line 4, the "interlocking blocks".

-lines 4 and 5, the "reinforcing element".

-line 5, the "latch mechanism".

-line 6, the "interlocking mating holes".

-line 7, the "post section".

In claim 22:

-line 3, the "interlocking block".

-line 4, the "interlocking mating hole".

-lines 4 and 5, the "reinforcing element".

-line 5, the "striker".

-line 5, the "latch mechanism".

In claim 23:

-line 3, "the interlocking block".

-line 5, the "interlocking mating hole".

-line 5, the "post section".

-lines 5 and 6, the "reinforcing element".

-line 6, the "striker".

-line 6, the "latch mechanism".

In claim 24:

-line 2, the "U-shaped window-guide element".

In claim 25:

-line 2, the “U-shaped window-guide elements”.

In claim 26:

-lines 2 and 3, the “window-guides”.

In claim 27:

-lines 1 and 2, the “window guides”.

In claim 28:

-line 4, the “interlocking hook”.

-line 5, the “interlocking block”.

In claim 29:

-line 2, the “washer”.

In claim 30:

-line 2, the “screw”.

In claim 31:

-line 2, the "screw".

In claim 32:

-line 1, the "sleeve".

In claim 33:

-line 5, the "supporting door frame".

-line 14, the "compound assembly".

In claim 34:

-lines 3 and 4, the "reinforcing element, transverse girder, reinforcing rod, plate, panel, and U-shaped block.

In claim 1, the phrase "generally representing a tailgate, sliding side, cargo, liftgate door, trunk cover and vehicle door" is indefinite. The phraseseemss to claim the vehicle door to represent all of the listed structures at the same time. It is suggested that the word "and" should be changed to --or--.

In claim 1 the phrase "arranged to that door frame" in lines 9 and 10 isindefinited for failing toparticularlyy point out the relationship between the interlocking parts and the door frame.

In claim 1 line 10, the phrase "interlocking mating part to the vehicle body" is indefinite for failing to particularly point out the structural relationship between the interlocking mating part and the vehicle body.

In claim 1 line 12, the phrase "mechanisms to adjust to clearances of adjustable interlocking assemblies" is indefinite for failing to particularly point out what clearance between what parts is adjustable.

In claim 1, lines 13-17, the phrase "thus ensuring the engagement of all..............in the event of any real collision and/or rollover" is narrative in nature and fails to distinctly point out the structure of the invention.

In claim 2, lines 2 and 3, the phrase "reinforced by a reinforcing element and transverse girder" fails to distinctly claim the structural relationship between the vehicle part, reinforcing element, and the transverse girder.

In claims 3 and 4, line 2, the phrase "vehicle roof or siderail" is indefinite and fails to distinctly claim if the vehicle part is a roof or side rail. These vehicle parts are not interchangeable, and thus cannot be referred to in the alternative.

In claims 3 and 4, line 4 the phrase "disposed along that vehicle part" is indefinite and fails to distinctly claim the relationship between the reinforcing rod and the vehicle part.

In claim 5, line 4 the phrase "disposed along" is indefinite and fails to distinctly claim the relationship between the reinforcing rods and the vehicle roof and side rail.

In claims 6 and 7, lines 7 and 8, the phrase "transverse girder of the mutual post sections" fails to distinctly claim the structural relationship between the girder and the post section.

In claim 9 lines 3, the phrase "defined by disposing" does not distinctly claim the structural relationship between the structures in the claim.

In claim 10, lines 5 and 6, the phrase " reinforcing plate of the post section" indefinite and fails to distinctly claim the relationship between the reinforcing plate and the post section.

In claims 10 and 11 the phrase "disposed along the vehicle roof or side rail" is indefinite for failing to particularly point out the relationship between the reinforcing plate and the vehicle roof or side rail. It also is indefinite for failing to claim either the roof or side rail.

In claim 11, the use of the word "or" in line 7 renders the claim indefinite because it attempts to claim 2 different structures in one claim.

In claims 12, 13, 14, 15, and 21, the use of the word "disposed" renders the claim indefinite, as in the examples provided above.

In claim 16, line 5, the phrase "arranged in the auxiliary part" is indefinite and fails to distinctly claim the relationship between the interlocking mating hole and the auxiliary part.

In claim 18 lines 2 and 3, the phrase "adapted to the outer door-contour" and the phrase arranged to the window-guide" are indefinite and fail to distinctly claim the relationship between the auxiliary part and the window-guide element and impact beams.

In claims 20, 22, and 23 the phrase "arranged in the post section" is indefinite and fails to distinctly claim the relationship between the post section and the interlocking mating hole.

In claim 28, the phrase "with interior diameter d1 and gap s1" is indefinite since the shape of the interlocking hook is not positively recited.

In claim 32, the phrase "interlocking part with exterior diameter d" is indefinite since the shape of the interlocking part is not positively recited.

In claim 33, the phrase "generally representing a tailgate, sliding side, cargo, liftgate, and vehicle door" is indefinite. The phrase seems to claim the vehicle door to represent all of the listed structures at the same time. It is suggested that the word "and" should be changed to --or--

.

In claim 33 the phrase "arranged to that door frame" in line 10 is indefinite for failing to particularly point out the relationship between the interlocking parts and the door frame.

In claim 33 line 11, the phrase "interlocking mating part to the vehicle body" is indefinite for failing to particularly point out the structural relationship between the interlocking mating part and the vehicle body.

In claim 33 line 12, the phrase "mechanisms to adjust to clearances of adjustable interlocking assemblies" is indefinite for failing to particularly point out what clearance between what parts is adjustable.

In claim 33, lines 14-21, the phrase "wherein the interlocking ....in the event of any real collision and/or rollover" is narrative in nature and fails to distinctly point out the structure of the invention.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

11. Claims 1, 2, 9-27, 33, and 34 are rejected, as best understood, under 35 U.S.C. 102(e) as being anticipated by Townsend.

Townsend discloses a main vehicle body having at least one door aperture therein, a mating vehicle door (110) whose stiff supporting door frame, defined by at least two stiff impact beams stiff auxiliary parts and at least one stiff window guide element to guide and receive a window pane (figure 2) is hingedly secured to that vehicle body for pivotal movement between an open and a closed position. Interlocking assemblies (130, 138, 140, 134, 132, 128) are included, each of which include an interlocking part arranged to the door frame and an interlocking mating part to the vehicle body. Adjusting mechanisms to adjust clearances (lines 38-59, column 10) of interlocking assemblies which are in engagement when the vehicle door is in a closed position. pairs including a vehicle door and vehicle roof, a vehicle door and a side rail, a vehicle door and post section, a vehicle door and a vehicle door, and a vehicle door and a passenger compartment.

Allowable Subject Matter

12. Claims 3-8 and 28-32 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

13. Claims 3-8 and 28-32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. *An examination of this application reveals that applicant is unfamiliar with patent prosecuting procedure. While an inventor may prosecute the application, lack of skill in this field usually acts as a liability in affording the maximum protection for the invention disclosed. Applicant is advised to secure the services of a registered patent attorney or agent to prosecute the application, since the value of a patent is largely dependent upon skillful preparation and prosecution. The Office cannot aid in selecting an attorney or agent.*

Applicant is advised of the availability of the publication "Attorneys and Agents Registered to Practice Before the U.S. Patent and Trademark Office." This publication is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Morrow whose telephone number is (703) 305-7803. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 5:00 PM.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1113.

The fax phone number for the organization where this application or proceeding is assigned is (703) 305-7687.

jsm

JASON MORROW
PATENT EXAMINER

October 8, 1998

D. GLENN DAYOAN
PRIMARY EXAMINER
GROUP 310

Office Action Summary

Application No.	Applicant(s)
08/860,182	Go
Examiner	**Group Art Unit**
Jason Morrow	3612

☒ Responsive to communication(s) filed on *Dec 23, 1998*.

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-34* is/are pending in the application.

Of the above, claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) *1, 2, 9-27, 33, and 34* is/are rejected.

☒ Claim(s) *3-8 and 28-32* is/are objected to.

☐ Claims ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☒ The drawing(s) filed on *Dec 23, 1998* is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on ______ is ☐approved ☐disapproved.

☒ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☒ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- *SEE OFFICE ACTION ON THE FOLLOWING PAGES* ---

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Germany on November 7, 1996. It is noted, however, that applicant has not filed a certified copy of the German application as required by 35 U.S.C. 119(b).

Drawings

2. Figures 1A, 1B, 2, 2A, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 18 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

Specification

3. Applicant is reminded of the proper content of an abstract of the disclosure.

A patent abstract is a concise statement of the technical disclosure of the patent and should include that which is new in the art to which the invention pertains. If the patent is of a basic nature, the entire technical disclosure may be new in the art, and the abstract should be directed to the entire disclosure. If the patent is in the nature of an improvement in an old apparatus, process, product, or composition, the abstract should include the technical disclosure of the improvement. In certain patents, particularly those for compounds and compositions, wherein the process for making and/or the use thereof are not obvious, the abstract should set

forth a process for making and/or use thereof. If the new technical disclosure involves modifications or alternatives, the abstract should mention by way of example the preferred modification or alternative.

The abstract should not refer to purported merits or speculative applications of the invention and should not compare the invention with the prior art.

Where applicable, the abstract should include the following:

(1) if a machine or apparatus, its organization and operation;

(2) if an article, its method of making;

(3) if a chemical compound, its identity and use;

(4) if a mixture, its ingredients;

(5) if a process, the steps.

Extensive mechanical and design details of apparatus should not be given.

4. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 250 words. It is important that the abstract not exceed 250 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as

"means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

5. The abstract of the disclosure is objected to because it is not narrative in nature and it refers to the speculative merits of the invention. Correction is required. See MPEP § 608.01(b).

6. Applicant is advised on how to arrange the content of the specification.

Content of Specification

(a) Title of the Invention: See 37 CFR 1.72(a). The title of the invention should be placed at the top of the first page of the specification. It should be brief but technically accurate and descriptive, preferably from two to seven words.

(b) Cross-References to Related Applications: See 37 CFR 1.78 and MPEP § 201.11.

© Statement Regarding Federally Sponsored Research and Development: See MPEP § 310.

(d) Reference to a "Microfiche Appendix": See 37CFR 1.96© and MPEP § 608.05. The total number of microfiche and the total number frames should be specified.

(e) Background of the Invention: The specification should set forth the Background of the Invention in two parts:

(1) Field of the Invention: A statement of the field of art to which the invention pertains. This statement may include a paraphrasing of the applicable U.S. patent classification definitions of the subject matter of the claimed invention. This item may also be titled "Technical Field."

(2) Description of the Related Art: A description of the related art known to the applicant and including, if applicable, references to specific related art and problems involved in the prior art which are solved by the applicant's invention. This item may also be titled "Background Art."

(f) Brief Summary of the Invention: A brief summary or general statement of the invention as set forth in 37 CFR 1.73. The summary is separate and distinct from the abstract and is directed toward the invention rather than the disclosure as a whole. The summary may point out the advantages of the invention or how it solves problems previously existent in the prior art (and preferably indicated in the Background of the Invention). In chemical cases it should point out in general terms the utility of the invention. If possible, the nature and gist of the invention or the inventive concept should be set forth. Objects of the invention should be treated briefly and only to the extent that they contribute to an understanding of the invention.

(g) Brief Description of the Several Views of the Drawing(s): A reference to and brief description of the drawing(s) as set forth in 37 CFR 1.74.

(h) Detailed Description of the Invention: A description of the preferred embodiment(s) of the invention as required in 37 CFR 1.71. The description should be as short and specific as is necessary to describe the invention adequately and accurately. This item may also be titled "Best Mode for Carrying Out the Invention." Where elements or groups of elements, compounds, and processes, which are conventional and generally widely known in the field of the invention described and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art, they should not be described in detail. However, where particularly complicated subject matter is involved or where the elements, compounds, or processes may not be commonly or widely known in the field, the specification should refer to another patent or readily available publication which adequately describes the subject matter.

(I) Claim or Claims: See 37 CFR 1.75 and MPEP § 608.01(m). The claim or claims must commence on separate sheet. (37 CFR 1.52(b)). Where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation. There may be plural indentations to further segregate subcombinations or related steps.

(j) Abstract of the Disclosure: A brief narrative of the disclosure as a whole in a single paragraph of 250 words or less on a separate sheet following the claims.

(k) Drawings: See 37 CFR 1.81, 1.83-1.85, and MPEP § 608.02.

(l) Sequence Listing: See 37 CFR 1.821-1.825.

7. The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper. Applicant is required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or a practitioner representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973).

8. The attempt to incorporate subject matter into this application by reference to any German Patent Application, European Patent Applications, or by any other publication except for a U.S. Patent is improper because these materials are not readily available to the general public.

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of 37 CFR 1.71(a)-(c):

> (a) The specification must include a written description of the invention or discovery and of the manner and process of making and using the same, and is required to be in such full, clear, concise, and exact terms as to

> enable any person skilled in the art or science to which the invention or discovery appertains, or with which it is most nearly connected, to make and use the same.
>
> (b) The specification must set forth the precise invention for which a patent is solicited, in such manner as to distinguish it from other inventions and from what is old. It must describe completely a specific embodiment of the process, machine, manufacture, composition of matter or improvement invented, and must explain the mode of operation or principle whenever applicable. The best mode contemplated by the inventor of carrying out his invention must be set forth.
>
> © In the case of an improvement, the specification must particularly point out the part or parts of the process, machine, manufacture, or composition of matter to which the improvement relates, and the description should be confined to the specific improvement and to such parts as necessarily cooperate with it or as may be necessary to a complete understanding or description of it.

The specification is objected to under 37 CFR 1.71 because it fails to provide an adequate description of the invention. The *Description of the Preferred Embodiments* should include more than a simple listing of the parts present in each embodiment. This section should also point out the how the parts of the invention function during use. Applicant is also reminded that the specification, excluding the claims, should be ***narrative*** in nature. Although the listing of elements and ideas in a the disclosure is permissible, the bulk of the disclosure should be narrative. ***See the cited U.S. patents as examples of disclosures with correct form.***

10. If applicant continues to prosecute the application, revision of the specification and claims to present the application in proper form is required. While an application can be amended to make it clearly understandable, no subject matter can be added that was not disclosed in the application as originally filed.

11. The disclosure is objected to because of the following informalities: 35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms which are not clear, concise and exact. The specification should

be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: "ejected from (hurled out of)", "compartment (cell)", "uniform (constant)", "clamping means (engaging means)", "arbitrary collision", and "spatially S-shaped" .

Appropriate correction is required.

Claim Objections

12. Claims 3-34 are objected to under 37 CFR 1.75© as being in improper form because a multiple dependent claim should refer to other claims in the alternative only and cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claims have not been further treated on the merits.

13. The claims are objected to because they include reference characters which are not enclosed within parentheses.

Reference characters corresponding to elements recited in the detailed description of the drawings and used in conjunction with the recitation of the same element or group of elements in the claims should be enclosed within parentheses so as to avoid confusion with other numbers or characters which may appear in the claims. See MPEP § 608.01(m).

14. The claims are objected to because the lines are crowded too closely together, making reading and entry of amendments difficult. Substitute claims with lines one and one-half or double spaced on good quality paper are required. See 37 CFR 1.52(b).

15. Claims 1 and 2 are objected to because of the following informalities: Reference to specific parts of in the drawings as in the phrase "with the exception of clamping part 15.4a" in line 8 of claim 1 is improper. Appropriate correction is required.

Claim Rejections - 35 USC § 112

16. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

17. Claims 1 and 2 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "clamping means (clamping parts/clamping parts)" in line 6 of claim 1, the phrase "such as clamping holes/clamping blocks" in line 6 of claim 1, the phrase "clamping hooks 15.6/reinforcing rod 17.1d", the term "arrangement" in line 14 of claim 1 and line 2 of claim 2 (which fails to distinctly point out the arrangement of the invention), the phrase "clamping means 17.1d/ several clamping hooks 15.6" in line 5 of claim 2, and the term "real

arbitrary collision" in line 1 of claim 2 are all indefinite for failing to distinctly claim subject matter of the invention.

In claim 1, line 1, it is unclear what is meant by the phrase "door truss".

In claim 1 line 19, the phrase "form-locking by adjustment to the permissible tolerances" is indefinite because the term "form-locking" does not clearly recite structure of the invention. The phrase "permissible tolerances" is also indefinite since this phrase does not limit the invention to any particular range of tolerances. Also the phrase appears to recite a method of manufacture (form-locking by adjustment) instead of a structure of the apparatus (an adjustment means) which is inconsistent with the preamble of the claim, thus rendering the scope of the claim unascertainable.

In line 20 of claim 1, the term "perfect interengagement" is indefinite since the definition of "perfect" is not clearly defined.

In claim 2, the preamble of the claim seems to be directed to a different invention than that in the preamble of claim 1 from which it depends, thus rendering the scope of the claim unascertainable.

Claim Rejections - 35 USC § 102

18. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

19. Claims 1 and 2 are rejected under 35 U.S.C. 102(b) as being anticipated by Townsend. Townsend discloses a vehicle door equipped with a door truss comprising at least two impact beams (36), at least one window-guide element (figure 7) to guide and receive a window pane where clamping means exist (130, 138, 140, 134, 132, 128) that are equipped with means to adjust them to permissible tolerances (lines 38-59, column 10). The vehicle is also equipped with a plurality of compound pairs including a vehicle door and vehicle roof, a vehicle door and a side rail, a vehicle door and post section, a vehicle door and a vehicle door, and a vehicle door and a passenger compartment.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Rossie et al. discloses an interlock device for a vehicle door. Cornacchia discloses an interlock device for a vehicle door. Pavlik discloses a interlock device for a vehicle door. Ball discloses an interlock device for a vehicle door. Hull et al. discloses an interlock device for a vehicle door. Thum discloses an interlock device for a vehicle door. Freudenberger discloses an interlock mechanism for a vehicle door.

21. ***An examination of this application reveals that applicant is unfamiliar with patent prosecuting procedure. While an inventor may prosecute the application, lack of skill in this***

field usually acts as a liability in affording the maximum protection for the invention disclosed. Applicant is advised to secure the services of a registered patent attorney or agent to prosecute the application, since the value of a patent is largely dependent upon skillful preparation and prosecution. The Office cannot aid in selecting an attorney or agent.

Applicant is advised of the availability of the publication "Attorneys and Agents Registered to Practice Before the U.S. Patent and Trademark Office." This publication is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Morrow whose telephone number is (703) 305-7803. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 5:00 PM.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1113.

The fax phone number for the organization where this application or proceeding is assigned is (703) 305-7687.

JASON MORROW
PATENT EXAMINER

D. GLENN DAYOAN
PRIMARY EXAMINER
GROUP 310

jsm

October 8, 1998

Notice of References Cited

Application No.	Applicant(s)
08/860,182	Go
Examiner	**Group Art Unit**
Jason Morrow	3612

Page 1 of 1

U.S. PATENT DOCUMENTS

	DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
A	3,788,686	1/29/74	Rossie et al.	296	146.6
B	3,819,228	6/25/74	Cornacchia	296	146.6
C	4,307,911	12/29/81	Pavlik	296	188
D	4,676,524	6/30/87	Ball et al.	296	146.6X
E	5,306,067	4/26/94	Hull et al.	296	146.6
F	5,806,917	9/15/98	Townsend	296	146.6X
G					
H					
I					
J					
K					
L					
M					

FOREIGN PATENT DOCUMENTS

	DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
N	4240416-1A	9/23/93	Germany	Thum	296	146.6
O	2,045,875	3/16/72	Germany	Freudenberger	296	146.6
P					----	----
Q						
R						
S						
T						

NON-PATENT DOCUMENTS

	DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
U		
V		
W		
X		

Office Action Summary	Application No. 08/860,182	Applicant(s) Go
	Examiner Jason Morrow	Group Art Unit 3612

☒ Responsive to communication(s) filed on *Jan 14, 1999*.

☒ This action is **FINAL**.

Sept. 24.99

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-34* is/are pending in the application.

Of the above, claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) *1, 2, 9-27, 33, and 34* is/are rejected.

☒ Claim(s) *3-8 and 28-32* is/are objected to.

☐ Claims ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on ______ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☒ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☒ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: *PCT/DE 96/02120*.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

Filing date 22.06.97

--- *SEE OFFICE ACTION ON THE FOLLOWING PAGES* ---

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

2. Figures 1A, 1B, 2, 2A, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 18 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). The designations should NOT include the German equivalent label to "Prior Art".

Specification

3. The abstract of the disclosure is objected to because it is not narrative in nature and it refers to the speculative merits of the invention. Correction is required. See MPEP § 608.01(b).

4. Applicant is advised on how to arrange the content of the specification.

Content of Specification

(a) Title of the Invention: See 37 CFR 1.72(a). The title of the invention should be placed at the top of the first page of the specification. It should be brief but technically accurate and descriptive, preferably from two to seven words.

(b) Cross-References to Related Applications: See 37 CFR 1.78 and MPEP § 201.11.

(c) Statement Regarding Federally Sponsored Research and Development: See MPEP § 310.

(d) Reference to a "Microfiche Appendix": See 37CFR 1.96© and MPEP § 608.05. The total number of microfiche and the total number frames should be specified.

(e) Background of the Invention: The specification should set forth the Background of the Invention in two parts:

(1) Field of the Invention: A statement of the field of art to which the invention pertains. This statement may include a paraphrasing of the applicable U.S. patent classification definitions of the subject matter of the claimed invention. This item may also be titled "Technical Field."

(2) Description of the Related Art: A description of the related art known to the applicant and including, if applicable, references to specific related art and problems involved in the prior art which are solved by the applicant's invention. This item may also be titled "Background Art."

(f) Brief Summary of the Invention: A brief summary or general statement of the invention as set forth in 37 CFR 1.73. The summary is separate and distinct from the abstract and is directed toward the invention rather than the disclosure as a whole. The summary may point out the advantages of the invention or how it solves problems previously existent in the prior art (and preferably indicated in the Background of the Invention). In chemical cases it should point out in general terms the utility of the invention. If possible, the nature and gist of the invention or the inventive concept should be set forth. Objects of the invention should be treated briefly and only to the extent that they contribute to an understanding of the invention.

(g) Brief Description of the Several Views of the Drawing(s): A reference to and brief description of the drawing(s) as set forth in 37 CFR 1.74.

(h) Detailed Description of the Invention: A description of the preferred embodiment(s) of the invention as required in 37 CFR 1.71. The description should be as short and specific as is necessary to describe the invention adequately and accurately. This item may also be titled "Best Mode for Carrying Out the Invention." Where elements or groups of elements, compounds, and processes, which are conventional and generally widely known in the field of the invention

described and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art, they should not be described in detail. However, where particularly complicated subject matter is involved or where the elements, compounds, or processes may not be commonly or widely known in the field, the specification should refer to another patent or readily available publication which adequately describes the subject matter.

(I) Claim or Claims: See 37 CFR 1.75 and MPEP § 608.01(m). The claim or claims must commence on separate sheet. (37 CFR 1.52(b)). Where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation. There may be plural indentations to further segregate subcombinations or related steps.

(j) Abstract of the Disclosure: A brief narrative of the disclosure as a whole in a single paragraph of 250 words or less on a separate sheet following the claims.

(k) Drawings: See 37 CFR 1.81, 1.83-1.85, and MPEP § 608.02.

(l) Sequence Listing: See 37 CFR 1.821-1.825.

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of 37 CFR 1.71(a)-(c):

(a) The specification must include a written description of the invention or discovery and of the manner and process of making and using the same, and is required to be in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which the invention or discovery appertains, or with which it is most nearly connected, to make and use the same.

(b) The specification must set forth the precise invention for which a patent is solicited, in such manner as to distinguish it from other inventions and from what is old. It must describe completely a specific embodiment of the process, machine, manufacture, composition of matter or improvement invented, and must explain the mode of operation or principle whenever applicable. The best mode contemplated by the inventor of carrying out his invention must be set forth.

© In the case of an improvement, the specification must particularly point out the part or parts of the process, machine, manufacture, or composition of matter to which the improvement relates, and the description should be confined to the specific improvement and to such parts as necessarily cooperate with it or as may be necessary to a complete understanding or description of it.

The specification is objected to under 37 CFR 1.71 because it fails to provide an adequate description of the invention. The *Description of the Preferred Embodiments* should include more than a simple listing of the parts present in each embodiment. This section should also point out the how the parts of the invention function during use. ***See the cited U.S. patents as examples of disclosures with correct form.***

6. If applicant continues to prosecute the application, revision of the specification and claims to present the application in proper form is required. While an application can be amended to make it clearly understandable, no subject matter can be added that was not disclosed in the application as originally filed.

Claim Objections

7. The claims are objected to because the lines are crowded too closely together, making reading and entry of amendments difficult. Substitute claims with lines one and one-half or double spaced on good quality paper are required. See 37 CFR 1.52(b).

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The following terms or phrases are inferentially recited in the claims:

In claim 1:

-line 6, the "supporting door frame".

-line 14, the "compound assemblies".

In claim 2:

-lines 1 and 2, the " vehicle part of vehicle body".

-line 3, the "post sections".

In claim 3:

-line 2 of claim 3, the "vehicle part".

In claim 4:

-line 2, the "vehicle part".

In claim 6:

-line 3, the "interlocking holes".

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block".

-line 6, the "mutual post section".

In claim 7:

-line 3, the "interlocking holes".

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block".

-line 7, the "side rail".

In claim 8:

-line 2, the "U-shaped block".

In claim 9:

-line 2, the "interlocking holes & interlocking blocks"

-line 3, the "post section".

-

In claim 10:

-lines 5 and 6, the "post section".

-line 6, the "reinforcing panel".

-line 7, the "side rail".

In claims 12 and 13:

-line 3, "interlocking holes".

-line 3, the "reinforcing panels".

-line 5, the "interlocking mating blocks".

In claim 14:

-line 3, the "interlocking blocks".

-line 3, the "reinforcing peripheral edges".

-line 5, the "interlocking mating holes".

In claim 15:

-line 3, the "interlocking block".

-line 4, the "top peripheral edge".

-line 5, the "interlocking mating holes".

In claim 16:

-line 4, the "bottom peripheral edge".

-line 3, the "interlocking block".

In claim 17:

-line 3, the “interlocking block”.

-lines 3 and 4, the “post-section peripheral edge”.

-line 5, the “interlocking mating hole”.

-line 5, the “auxiliary part”.

In claim 19:

- line 3, the “interlocking block”.

-line 4, the “post-section peripheral edge”.

-line 5, the “interlocking mating hole”.

-line 5, the “outer door-contour-shaped auxiliary part”.

In claim 20:

-line 5, the “post section”.

In claim 21:

-line 2, the “post section”.

-line 4, the “interlocking blocks”.

-lines 4 and 5, the “reinforcing element”.

-line 5, the “latch mechanism”.

-line 6, the "interlocking mating holes".

-line 7, the "post section".

In claim 22:

-line 3, the "interlocking block".

-line 4, the "interlocking mating hole".

-lines 4 and 5, the "reinforcing element".

-line 5, the "striker".

-line 5, the "latch mechanism".

In claim 23:

-line 3, "the interlocking block".

-line 5, the "interlocking mating hole".

-line 5, the "post section".

-lines 5 and 6, the "reinforcing element".

-line 6, the "striker".

-line 6, the "latch mechanism".

In claim 24:

-line 2, the "U-shaped window-guide element".

In claim 25:

-line 2, the “U-shaped window-guide elements”.

In claim 26:

-lines 2 and 3, the “window-guides”.

In claim 27:

-lines 1 and 2, the “window guides”.

In claim 28:

-line 4, the “interlocking hook”.

-line 5, the “interlocking block”.

In claim 29:

-line 2, the “washer”.

In claim 30:

-line 2, the “screw”.

In claim 31:

-line 2, the "screw".

In claim 32:

-line 1, the "sleeve".

In claim 33:

-line 5, the "supporting door frame".

-line 14, the "compound assembly".

In claim 34:

-lines 3 and 4, the "reinforcing element, transverse girder, reinforcing rod, plate, panel, and U-shaped block.

In claim 1, the phrase "generally representing a tailgate, sliding side, cargo, liftgate door, trunk cover and vehicle door" is indefinite. The phraseseemss to claim the vehicle door to represent all of the listed structures at the same time. It is suggested that the word "and" should be changed to --or--.

In claim 1 the phrase "arranged to that door frame" in lines 9 and 10 isindefinited for failing toparticularlyy point out the relationship between the interlocking parts and the door frame.

In claim 1 line 10, the phrase "interlocking mating part to the vehicle body" is indefinite for failing to particularly point out the structural relationship between the interlocking mating part and the vehicle body.

In claim 1 line 12, the phrase "mechanisms to adjust to clearances of adjustable interlocking assemblies" is indefinite for failing to particularly point out what clearance between what parts is adjustable.

In claim 1, lines 13-17, the phrase "thus ensuring the engagement of all..............in the event of any real collision and/or rollover" is narrative in nature and fails to distinctly point out the structure of the invention.

In claim 2, lines 2 and 3, the phrase "reinforced by a reinforcing element and transverse girder" fails to distinctly claim the structural relationship between the vehicle part, reinforcing element, and the transverse girder.

In claims 3 and 4, line 2, the phrase "vehicle roof or siderail" is indefinite and fails to distinctly claim if the vehicle part is a roof or side rail. These vehicle parts are not interchangeable, and thus cannot be referred to in the alternative.

In claims 3 and 4, line 4 the phrase "disposed along that vehicle part" is indefinite and fails to distinctly claim the relationship between the reinforcing rod and the vehicle part.

In claim 5, line 4 the phrase "disposed along" is indefinite and fails to distinctly claim the relationship between the reinforcing rods and the vehicle roof and side rail.

In claims 6 and 7, lines 7 and 8, the phrase "transverse girder of the mutual post sections" fails to distinctly claim the structural relationship between the girder and the post section.

In claim 9 lines 3, the phrase "defined by disposing" does not distinctly claim the structural relationship between the structures in the claim.

In claim 10, lines 5 and 6, the phrase " reinforcing plate of the post section" indefinite and fails to distinctly claim the relationship between the reinforcing plate and the post section.

In claims 10 and 11 the phrase "disposed along the vehicle roof or side rail" is indefinite for failing to particularly point out the relationship between the reinforcing plate and the vehicle roof or side rail. It also is indefinite for failing to claim either the roof or side rail.

In claim 11, the use of the word "or" in line 7 renders the claim indefinite because it attempts to claim 2 different structures in one claim.

In claims 12, 13, 14, 15, and 21, the use of the word "disposed" renders the claim indefinite, as in the examples provided above.

In claim 16, line 5, the phrase "arranged in the auxiliary part" is indefinite and fails to distinctly claim the relationship between the interlocking mating hole and the auxiliary part.

In claim 18 lines 2 and 3, the phrase "adapted to the outer door-contour" and the phrase arranged to the window-guide" are indefinite and fail to distinctly claim the relationship between the auxiliary part and the window-guide element and impact beams.

In claims 20, 22, and 23 the phrase "arranged in the post section" is indefinite and fails to distinctly claim the relationship between the post section and the interlocking mating hole.

In claim 28, the phrase "with interior diameter d1 and gap s1" is indefinite since the shape of the interlocking hook is not positively recited.

In claim 32, the phrase "interlocking part with exterior diameter d" is indefinite since the shape of the interlocking part is not positively recited.

In claim 33, the phrase "generally representing a tailgate, sliding side, cargo, liftgate, and vehicle door" is indefinite. The phrase seems to claim the vehicle door to represent all of the listed structures at the same time. It is suggested that the word "and" should be changed to --or--

.

In claim 33 the phrase "arranged to that door frame" in line 10 is indefinite for failing to particularly point out the relationship between the interlocking parts and the door frame.

In claim 33 line 11, the phrase "interlocking mating part to the vehicle body" is indefinite for failing to particularly point out the structural relationship between the interlocking mating part and the vehicle body.

In claim 33 line 12, the phrase "mechanisms to adjust to clearances of adjustable interlocking assemblies" is indefinite for failing to particularly point out what clearance between what parts is adjustable.

In claim 33, lines 14-21, the phrase "wherein the interlocking ....in the event of any real collision and/or rollover" is narrative in nature and fails to distinctly point out the structure of the invention.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

11. Claims 1, 2, 9-27, 33, and 34 are rejected, as best understood, under 35 U.S.C. 102(e) as being anticipated by Townsend.

Townsend discloses a main vehicle body having at least one door aperture therein, a mating vehicle door (110) whose stiff supporting door frame, defined by at least two stiff impact beams stiff auxiliary parts and at least one stiff window guide element to guide and receive a window pane (figure 2) is hingedly secured to that vehicle body for pivotal movement between an open and a closed position. Interlocking assemblies (130, 138, 140, 134, 132, 128) are included, each of which include an interlocking part arranged to the door frame and an interlocking mating part to the vehicle body. Adjusting mechanisms to adjust clearances (lines 38-59, column 10) of interlocking assemblies which are in engagement when the vehicle door is in a closed position. pairs including a vehicle door and vehicle roof, a vehicle door and a side rail, a vehicle door and post section, a vehicle door and a vehicle door, and a vehicle door and a passenger compartment.

Allowable Subject Matter

12. Claims 3-8 and 28-32 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

13. Claims 3-8 and 28-32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

14. This is a CPA of applicant's earlier Application No. 08/860,182. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. *An examination of this application reveals that applicant is unfamiliar with patent prosecuting procedure. While an inventor may prosecute the application, lack of skill in this field usually acts as a liability in affording the maximum protection for the invention disclosed. Applicant is advised to secure the services of a registered patent attorney or agent to prosecute the application, since the value of a patent is largely dependent upon skillful preparation and prosecution. The Office cannot aid in selecting an attorney or agent.*

Applicant is advised of the availability of the publication "Attorneys and Agents Registered to Practice Before the U.S. Patent and Trademark Office." This publication is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Morrow whose telephone number is (703) 305-7803. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 5:00 PM.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1113.

The fax phone number for the organization where this application or proceeding is assigned is (703) 305-7687.

jsm

August 30, 1998

JASON MORROW
PATENT EXAMINER

D. GLENN DAYOAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

E 11 Fax of -1- claims 09/10/98 **E11**

1. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

b) a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and

d) adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar and
- vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

2. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;

b) three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon;

d) at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

e) adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle doors are closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar,
- series-connected vehicle doors & common pillar and

– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

3. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

b) a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and

d) adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

– vehicle door & vehicle roof **(17)**,

– vehicle door & side rail **(18)**,

– vehicle door & pillar and

– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

To Mr Manny (Unit 3612) 3 Page - Fax

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– vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

3. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

b) a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

(Unit 3662) 3 page-Fax

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

4. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

b) a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar and
- vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

To Mr. Morgan (Unit 3612)

5. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;

b) three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

d) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar,
- series-connected vehicle doors & common pillar and
- vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

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thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

6. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & vehicle roof **(17)** consists of

- at least two hooks **(15.6)** mounted to the window-guide elements **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and
- the mating rod **(17.1d)**, serving as key, arranged along that vehicle roof and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

7. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & side rail **(18)** consists of

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

6. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assembly of vehicle door & vehicle roof **(17)** consists of

- at least two hooks **(15.6)** mounted to the window-guide elements **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and
- the mating rod **(17.1d)**, serving as key, arranged along that vehicle roof and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

7. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assembly of vehicle door & side rail **(18)** consists of

- at least two hooks **(15.6)** mounted to the window-guide elements **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and
- the mating rod **(17.1d)**, serving as key, arranged along that side rail and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

8. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assemblies of series-connected vehicle doors & vehicle roof **(17)** and series-connected vehicle doors & side rail **(18)** consist of

- at least eight hooks **(15.6)** mounted to the corresponding window-guide elements; and
- two mating rods **(17.1d)** arranged along that vehicle roof, side rail and mounted to three transverse girders **(17.2e, 17.2f, 17.2g)** connecting all pillars of both vehicle sides to each other.

9. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assembly of vehicle door & pillar, whereto the door hinges are fastened, consists of

- a key **(15.1)** bolted to the intersection region of the pillar and roof, which is reinforced by a plate **(17.1c)** and transverse girder **(17.2d)** connecting the pillars of both vehicle sides to each other; and
- the mating hole arranged to the window-guide element **(6.1a, 6.2a, 6.1aB, 6.2aB)**.

10. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & vehicle roof consist of

- a key **(15.2a)**, bolted to an element **(6.11)** rigidly attached to the respective window-guide element **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**, and a plurality of the keys **(15.2)**, bolted to the respective window-guide elements; and
- the mating holes arranged to the vehicle roof **(17)**, reinforced by a plate **(17.1, 17.1a)** and transverse plate **(17.2a)** connecting the pillars of both vehicle sides to each other.

11. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & side rail consist of

- a plurality of keys **(15.4, 15.4a)** mounted to the respective window-guide elements **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**; and
- the mating holes arranged to the side rail **(18)** reinforced by an element **(18.1, 18.1a)**.

12. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assemblies of vehicle door & vehicle roof and vehicle door & side rail consist of

- a plurality of keys **(15.2, 15.4, 15.4a)** mounted to the respective window-guide elements **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**; and
- the mating holes arranged to the vehicle roof **(17)**, reinforced by the plate **(17.1a)**, and to the side rail **(18)**, reinforced by the element **(18.1, 18.1a)**.

13. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle doors & flange **(21)** of vehicle body **(20)** consist of

- a plurality of keys **(30, 32, 35)** bolted to the reinforced flange **(21)** of vehicle body **(20)**; and
- the mating holes arranged to the housings **(6.5, 6.5B)** rigidly attached to the window-guide elements **(6, 6B)**, elements **(6.6b, 6.7b, 6.8)** and impact beams **(7, 7B)**, respectively.

14. An increased stiffness of vehicle structure according to claim **1**, wherein an element **(6.5C)**, whose contour is adapted to the door-contour, is rigidly attached to the window-guide element **(6B)** and impact beams **(1B, 7B)**.

15. An increased stiffness of vehicle structure according to claim **14**, wherein the adjustable interengaging assemblies consist of

- a plurality of keys **(37)** bolted to the rear flange **(21)** of vehicle body **(20)** reinforced by an element **(21.4B, 21.6B, 21.5B)**; and
- the mating holes arranged to the door-contour-shaped element **(6.5C)**.

16. An increased stiffness of vehicle structure according to claim **1**, wherein the hook **(15.6)**, adjustable from outside the vehicle, comprises a screw **(15.21)**, a number of spacers **(15.22)**, washer **(15.24)**, nut **(15.25)** and a hook with interior diameter d_1 and a gap s_1.

* * * KOMMUNIKATIONSERGEBNISBERICHT (10.SEP.1999 21:33) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
644	SPEICHER SENDEN		VSPTO	OK	S. 3/3

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

17. An increased stiffness of vehicle structure according to claim 1, wherein the key, adjustable from outside the vehicle, comprises mechanical connection elements such as a screw (15.14), large washer (15.13) with outer diameter D, a number of spacers (15.12) and a sleeve (15.11), both have a total length l.

18. An increased stiffness of vehicle structure according to claim 17, wherein the sleeve (15.11) of the key with exterior diameter d is governed by the equation $D \geq d \geq d_R$, where D is the exterior diameter of washer (15.13) and d_R is the diameter of spacer (15.12) and sleeve.

19. An increased stiffness of vehicle structure according to claim 17, wherein the front region of washer (15.13) has radial teeth.

17. An increased stiffness of vehicle structure according to claim **1**, wherein the key, adjustable from outside the vehicle, comprises mechanical connection elements such as a screw **(15.14)**, large washer **(15.13)** with outer diameter D, a number of spacers **(15.12)** and a sleeve **(15.11)**, both have a total length l.

18. An increased stiffness of vehicle structure according to claim **17**, wherein the sleeve **(15.11)** of the key with exterior diameter d is governed by the equation $D \geq d \geq d_R$, where D is the exterior diameter of washer **(15.13)** and d_R is the diameter of spacer **(15.12)** and sleeve.

19. An increased stiffness of vehicle structure according to claim **17**, wherein the front region of washer **(15.13)** has radial teeth.

20. An increased stiffness of vehicle structure according to claim **17**, wherein the washer is an integral part of a screw.

21. An increased stiffness of vehicle structure according to claim **1**, wherein both ends of the U-shaped window-guide element **(6, 6B)**, facing the lower vehicular member of vehicle body **(20)**, and an upper portion of that window-guide element, facing the upper vehicular member of vehicle body **(20)**, accommodate the members of interengaging assemblies.

22. An increased stiffness of vehicle structure according to claim **21**, wherein both ends of the respective stiff U-shaped window-guide element **(6, 6B)** are connected to each other by an element **(6.4, 6.4B)**.

23. An increased stiffness of vehicle structure according to claim **1**, wherein the window-guides **(6.1, 6.2, 6.1B, 6.2B)** are rigidly attached to the respective stiff window-guide elements **(6.1a, 6.2a, 6.1aB, 6.2aB)**.

24. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & pillar, whereto the vehicle door hinges are fastened, consist of

- a plurality of keys **(31, 36)** bolted to an element **(6.6a, 6.8)** rigidly attached to the window-guide element **(6, 6B)** and impact beams **(1, 1B, 7, 7B)**; and
- the mating holes arranged to the pillar reinforced by an extension member **(23)** and adjacent to that window-guide element.

25. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

- at least one pair of keys **(15.3, 15.3a)** bolted to both legs of extension member **(17.3)** mounted to the common pillar, reinforced by a plate **(17.1b)**, arranged along the vehicle roof **(17)** and attached rigidly to a transverse girder **(17.2c)**, connecting the common pillars of both vehicle sides to each other; and
- the mating holes arranged to both window-guide elements of series-connected vehicle doors adjacent to that common pillar.

26. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

- at least one pair of keys **(15.5, 15.5a)** bolted to both legs of extension member **(18.3)** mounted to the common pillar, reinforced by an element **(18.1b)**, arranged along the side

rail **(18)** and attached rigidly to a transverse girder **(18.2)**, connecting the common pillars of both vehicle sides to each other; and

– the mating holes arranged to both window-guide elements of series-connected vehicle doors adjacent to that common pillar.

27. An increased stiffness of vehicle structure according to claim **26**, wherein a belt case **(26)** is accommodated in the extension member **(18.3)**.

28. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8)** & pillar, operating in two planes, are defined by

– a plurality of keys **(33)** bolted to the window-guide element and a plurality of keys **(34)** bolted to an element **(6.7a)** rigidly attached to the window-guide element **(6)** and impact beams **(1, 7)**; and

– the mating receptacles arranged to the reinforced pillar.

29. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & pillar, operating in three planes, are defined by

– a plurality of keys **(15.1)** rigidly arranged to the reinforced pillar, whereto the door frame is hingedly secured, and a plurality of keys **(30, 31, 35, 36)** rigidly arranged to the reinforced flange of vehicle body **(20)**; and

– the mating receptacles arranged to the window-guide element **(6.1a, 6.2a)**, elements **(6.6a, 6.8)** and housings **(6.5, 6.5B)**, respectively.

* * * KOMMUNIKATIONSERGEBNISBERICHT (10.SEP.1999 21:34) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
645	SPEICHER SENDEN		VSPTO	OK	S. 2/2

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

30. An increased stiffness of vehicle structure according to claim 3, wherein the adjustable interengaging assemblies of vehicle door (8, 8B) & side rail (18), operating in three planes, are defined by

- a plurality of keys (15.4a) rigidly arranged to the side rail (18) and at least two keys (30, 32, 35, 37) rigidly arranged to the reinforced flange (21) of vehicle body (20); and
- the mating receptacles arranged to the window-guide elements (6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B), door-contour-shaped element (6.5C) and housings (6.5, 6.5B), respectively.

31. An increased stiffness of vehicle structure according to claim 4, wherein the interengaging assemblies of vehicle door (8, 8B) & vehicle roof (17), operating in four planes, are defined by

- a plurality of keys (15.2, 15.2a) rigidly arranged to the respective window-guide

2 Page-Fax

30. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & side rail **(18)**, operating in three planes, are defined by

- a plurality of keys **(15.4a)** rigidly arranged to the side rail **(18)** and at least two keys **(30, 32, 35, 37)** rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and
- the mating receptacles arranged to the window-guide elements **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**, door-contour-shaped element **(6.5C)** and housings **(6.5, 6.5B)**, respectively.

31. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of vehicle door **(8, 8B)** & vehicle roof **(17)**, operating in four planes, are defined by

- a plurality of keys **(15.2, 15.2a)** rigidly arranged to the respective window-guide elements **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)** and at least two keys **(30, 32, 35, 37)** rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and
- the mating receptacles arranged to the reinforced vehicle roof **(17)** and that window-guide elements, respectively.

32. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of connecting vehicular couples, operating in multi-planes, are defined by

- a plurality of keys **(15.1 to 15.7, 30, 32, 35, 37)** rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and
- the mating receptacles arranged to the reinforced portions of vehicle doors, respectively.

33. An increased stiffness of vehicle structure according to claim **5**, wherein the interengaging assemblies of series-connected vehicle doors & common pillar, operating in multi-planes, are defined by

- a plurality of keys **(15.3, 15.3a, 15.5, 15.5a)** rigidly arranged to the extension members **(17.3, 18.3, 23)** of the common pillar and a plurality of keys **(33, 34, 36)** rigidly arranged to the reinforced portions of series-connected vehicle doors, respectively; and
- the mating receptacles arranged to the reinforced portions of series-connected vehicle doors and the reinforced common pillar, respectively.

34. An increased stiffness of vehicle structure, characterised by use of metal, compound material, glass fibre reinforced material or non-metal material for material of the engaging key, receptacle, window-guide element, element, transverse girder, rod, plate and extension member.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/860,182	06/22/97	DJIEN GO	L

PM82/1008

GIOK DJIEN GO
PFAHLGRABENSTR. 45
D-65510 IDSTEIN
FED REP GERMANY

AIR MAIL

EXAMINER	
MORROW, J	
ART UNIT	PAPER NUMBER
3612	22

DATE MAILED: 10/08/99

Please find below and/or attached an Office communication concerning this application or proceeding.

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DETAILED ACTION

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

of Feb/10/99.

Specification

2. The disclosure is objected to under 37 CFR 1.71, as being so incomprehensible as to preclude a reasonable search of the prior art by the examiner. For example, the following items are not understood: the frequent references to foreign and U.S. patent documents as well as other publications to explain the differences between the prior art and the current invention make the comparisons throughout the disclosure incomprehensible. The disclosure does not stand on its own and is not understandable without these additional documents.

Applicant is required to submit an amendment which clarifies the disclosure so that the examiner may make a proper comparison of the invention with the prior art.

Applicant should be careful not to introduce any new matter into the disclosure (i.e., matter which is not supported by the disclosure as originally filed).

A shortened statutory period for reply to this action is set to expire thirty days or ONE MONTH, whichever is longer, from the mailing date of this letter.

Remarks

Applicant is encouraged to contact the examiner before responding to this Office Action.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Morrow whose telephone number is (703) 305-7803. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 5:00 PM.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1113.

The fax phone number for the organization where this application or proceeding is assigned is (703)305-7687.

jsm

October 7, 1999

JASON MORROW
PATENT EXAMINER

D. GLENN DAYOAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

703 308 21..

E15

United States Patent and Trademark Office

Fax

To:	Giok Djien Go	**From:**	Examiner Jason Morrow
Fax:	49 6126 8949	**Pages:**	~~24~~ 7 including coversheet
Phone:		**Date:**	10/29/99 6 10 p.m. Call
Re:	Specification for 08/860,182	**CC:**	

☐ **Urgent** ☑ **For Review** ☐ **Please Comment** ☑ **Please Reply** ☐ **Please Recycle**

• **Comments:** Go, please review the changes I have made to the specification. I have not corrected the entire document, but I have tried to give you an idea of the changes I would like you to make on pages 1-7. Try to eliminate the references to specific vehicle crashes and instead concentrate on the general reasons why the invention is unobvious and useful. You do not need to use evidence to support your conclusions in the Background of the Invention. Your statement and oath is evidence enough. The purpose of the Patent is not to scrutinize your research, but merely to describe your invention such that someone of ordinary skill will be able to understand and reproduce it.

Accordingly, the Description of the Preferred Embodiments section of the Patent is more important. The purpose of this section is not to simply list the parts. Please avoid doing this. It is unnecessary. Do not explain in words what can be seen in the drawings. Instead, explain the reasoning for the invention to be constructed in the manner it is and the function of the various parts. It is necessary to explain clearly how the invention works. Avoid listing parts and stating what is attached to what. This section should be NARRATIVE and EASILY UNDERSTADABLE. Do not use "listing" as shown in lines 17-31 of page 13.

In short, please revise the entire specification, removing unnecessary information from the Background of the Invention and concentrating on the Description of the Preferred Embodiments. Keep in mind that NO NEW MATTER may be entered into the case at this point.

When you have completed the revision of the specification, please contact me again and let me know when you will fax me the revised draft to (703) 308-3297.

Phone: **Date:** 10/29/99 6 p.m. Call.

Re: Specification for 08/860,182 **CC:**

☐ **Urgent** ☑ **For Review** ☐ **Please Comment** ☑ **Please Reply** ☐ **Please Recycle**

● **Comments:** Go, please review the changes I have made to the specification. I have not corrected the entire document, but I have tried to give you an idea of the changes I would like you to make on pages 1-7. Try to eliminate the references to specific vehicle crashes and instead concentrate on the general reasons why the invention is unobvious and useful. You do not need to use evidence to support your conclusions in the Background of the Invention. Your statement and oath is evidence enough. The purpose of the Patent is not to scrutinize your research, but merely to describe your invention such that someone of ordinary skill will be able to understand and reproduce it.

*A

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In short, please revise the entire specification, removing unnecessary information from the Background of the Invention and concentrating on the Description of the Preferred Embodiments. Keep in mind that NO NEW MATTER may be entered into the case at this point.

When you have completed the revision of the specification, please contact me again and let me know when you will fax me the revised draft to (703) 308-3297.

THREE DAYS

* Apparently, I should be a Hemingway!

Stuart,

Would you like to review my amended description? Deadline is Nov 5, at night I have to fax it to Marrow

Thanks in advance

Djuro

*A Had I NOT delivered my research report, USPTO would have

INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part application of co-pending international application number PCT/DE 96/02120 filed Nov. 7, 1996 and claiming the priority of DE 19543706 A1 filed Nov. 17, 1995. ~~This PCT/DE 96/02120 (WO 97/18984) is revised and refiled~~

~~- 06/03/97 and 07/08/97 for the purpose of amending the drawings, description, claims and contesting the prior art ref. to the German examination report of 09/09/96 and PCT search report of 03/24/97;~~

~~- 12/09/97 in order to correct and list the opposed prior art documents DE-OS 4342038-A1, DE-OS 2162071, U.S. Pat. No 4,307,911 (DE 3103580 A1), U.S. Pat. No 3,819,228, EP 0423465 A, EP 0642940 A (Patent family member U.S. Pat. No. 5,518,290), EP 0659601 A and DE 3726292 C1 in compliance with the PCT rules ref. to the preliminary PCT examination report of 10/02/97 and~~

~~- 12/07/98 in order to correct and list the opposed prior art documents U.S. Pat. No 3,788,686, U.S. Pat. No. 3,819,228, U.S. Pat. No 4,307,911, U.S. Pat. No 4,676,524, U.S. Pat. No 5,306,067, U.S. Pat. No 5,806,917, DE-OS 2405875 and DE 4240416 A1 ref. to U.S. examination report of 10/14/98.~~

~~The abbreviations DE and EP denote the German Pat. Application or Document and European Pat. Appl. or Doc., which will be omitted hereinafter.~~

~~All mentioned Pat. Appls./Docs, a 53-page report to the EU-Commission, US-, Canadian and Japanese Ministries for Transport, all accident reports by newspapers, German Police and the inventor listed in the Chap. "OTHER PUBLICATIONS" are parts of submittal.~~

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all post sections (pillar portions) and the flanges of door apertures of a vehicle body ~~(passenger compartment or cell)~~ thereby distributing energy to all those vehicle members, lowering stress thereof, preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) ~~and/~~or rollover ~~(overturn).~~

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"series-connected doors"	doors of one vehicle side are series-connected
"girder"	panel, shell, beam etc. according to FEM and Technical Mechanics

"*window-guide elements*" of vehicle doors	window-guides **6**, **6B**, **6.1**, **6.2**, **6.1B**, **6.2B**, **6.1a**, **6.2a**, **6.1aB**, **6.2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicle members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & post section/s, vehicle door & vehicle door in engagement in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicle members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type U2, one of four types shown in **Fig.** 13. However, all these conventional configurations do not take into account the failure of passenger protection due to the following problem cases in conjunction with disengagement of the mating parts of interengaging assemblies from each other in the event of all types of real collision (any real collision) and/or real rollover:

- **A** Load cases **I** to **V** according to Technical Mechanics/FEM in real front, side and rear collision;
- **B** Wrong assumption of the prior art for the purpose of idealizing a general side energy S or S_1 to a single energy S_x or S_{x1};
- **C** Analogy between the state of non-contact and disengagement;
- **D** Constant, small contour-clearance and assembly tolerance zones;
- **E** Large clearances of interengaging assemblies;
- **E1** The first inventions of interengaging assemblies, huge production costs and fatal injury in real collision due to large clearances;
- **E2** Large deformation of vehicle structure or door **8**. **8B** in real collision;
- **E3** Large deformation of side rail **18** in real collision;
- **E4** Large deformation of upper door frame **8.17** and vehicle roof **17** in real collision;
- **E5** Intrusion of vehicle roof **17** in vehicle body **20** in real rollovers; and
- **E6** Clamping assemblies or adjustable interengaging assemblies to resolve problem case **E**.

Evidence for failure of the prior art, resulting in door detachment associated with passenger ejection and intrusion of vehicle members and/or power plant (drive assembly) associated with severe/fatal injuries, is listed in the 53-page report [1] for the purpose of minimizing injury-severity level, number of injuries and injury-related costs, over $ 1 billion per day, in real accidents of vehicles world-wide, some of which, having always achieved very good to best verdicts in the front crash tests, are German and Volvo cars known world-wide as the safest. NHSTA [19] has confirmed the correctness of the theses and commitment therefor.

Problem case A: In order to idealize an impact force $2F_1$ in Fig. 10A imposed on a vehicle structure the following assumptions must be specified:

- let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.

Load case I in z-y plane in Fig. 5: The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all post sections, series-connected doors **8, 8B** reinforced by impact elements and interengaging assemblies of those doors and post sections, is subjected to the bending moment along the y-axis.

Load case **II** in z-x plane in Fig. 6: The force V exerts bending moment M_{zx} along the x-axis and rotating moment $M_y = V*b$ about the y-axis acts as torsional moment along the vehicle side.

Load case **III** in x-y plane in Fig. 7: The A-post section is under load of rotating moment $M_{xy} = -H*b$. The vehicle side is subjected to bending moment M_{xy} along the y-axis and buckling force H.

Subjected to the total stress of bending moments M_{zx}, M_{xy}, M_{zy}, buckling force H and torsional moments M_z, M_y in the load cases **I to III**, the vehicle side in **Fig. 8** is deformed in real front collision.

By reversibly arranging the series-connected doors **8, 8B** the same load cases are obtained for real rear collision.

Load case **IV** in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.

Load case **V** in z-x plane in Fig. 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column **22** in **Fig. 10A, 13** the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in load cases **IV** and **V**.

Problem case **B**: ~~With the exception of DE 4342038 A1,~~ THE MAJORITY OF the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases **IV** and **V** be idealized to a lateral energy S_x in **Fig.** 9 or S_{x1} in **Fig.** 10A imposing on the *centre* of vehicle door, illustrated as collision type U1 in **Fig.** 13, despite four collision types U1 to U4 [15] and the collision type U2 having the highest percentage of severe and fatal injuries. Nevertheless, car manufacturers and suppliers world-wide have adopted this idealized S_x or S_{x1} in inventions e.g. U.S. Pat. No. 4,307,911, U.S. Pat. No. 5,806,917, U.S. Pat. No. 5,518,290 (EP 0642940 A, DE 3934524), whose shortcomings are mentioned in the following problem case **E2**.

Problem case **C**: As exemplified in [2], reproduced in **Figs.** 11, 12, both end coils of compression-coil spring **19** are guided by two spring seats **19.1**. Their utmost outer nodes KN_1 and KN_{End} (not drawn) rest against both stops **19.3**, where i represents the number of coils. To survey the rolling behaviour of end coil **19** on the lower spring seat **19.1** the end coil is idealized in elements by supporting springs in reference to the nodes and by the threshold value of the distance in the "state of rolling" $s < 0.1$ mm. **Fig.** 12, [2] illustrate the rolling behaviour in regard to the FEM data and test results marked with M in dependence on $F_z = -790$, -1000 and -3000 N:

RELEVANT

UNCLEAR

- According to test results KN_2 to KN_5 roll on the spring seat at $F_z = -790$ N, but in the state of non-contact at $F_z = -1000$ and -3000 N.
- According to FEM data the nodes in the following states are in dependence on F_z:

F_z	State of contact	State of rolling
-100	KN_1, KN_{15}, KN_{17}	KN_1 to KN_3, KN_{10} to KN_{18}
-250	KN_1, KN_{19}, KN_{20}	KN_1, KN_{15} to KN_{23}
-1415	KN_1, KN_{17}, KN_{19}, KN_{20}, KN_{30}, KN_{31}, KN_{33}, KN_{34}	KN_1, KN_{15} to KN_{35}

When both end coils roll on the mating spring seats upon increase of energy, some nodes/elements thereof, previously in the state of contact, are in the state of non-contact. Analogously, interengaging assemblies are exposed to the disengagement.

Problem case **D**: Recently in automotive industry, great efforts have been made to achieve (finish) a constant (uniform), small contour clearance [16] between the outer door-contour "abcde" of vehicle door **8, 8B** and the door aperture of vehicle body **20** in **Fig.** 5. in order to minimize flow noise and, particularly, to achieve sales success in co-operation with an overall impression of attractive design. In the state of assembly the contour clearance e.g. of AUDI ® vehicles is only 2.5 mm and of VW Passat ® 3.5 mm~~, 0.5 mm less than Japanese vehicles according to VW CEO Dr. Piech [17]~~.

For the purpose of automatic assembly with the above-mentioned goal, a device ref. to DE 3726292 C1 determining six reference points on the outer door-contour calculates the differences between the outer door-contour and the door aperture (opening) of vehicle body **20** within the assembly tolerances by assembly, disassembly and assembly of the same vehicle door in **Fig.** 18.

UNCLEAR

Problem case **E**: The ~~position D_L of~~ door lock **248**, rigidly attached to vehicle door **8**, and the ~~position B_T of~~ striker **298**, rigidly attached to post section illustrated as **B**-post section in **Fig.** 10A of U.S. Pat. No 4,307,911 representing the prior art, is provided with locking clearances in x-, y- and z-direction, thus ensuring the state of door locking and the normal operation of vehicle door. For the purpose of preserving the constant, small contour-clearance,

- the position D_a to D_c of each key **128a to 128c**, rigidly attached to vehicle door **8**, and the position S_a to S_c of mating receptacle **158a to 158c**, rigidly attached to lower stiff panel **156** of side rail **18**;
- the position D_n of key **148**, rigidly attached to vehicle door **8**, and the position B_n of mating receptacle **198**, rigidly attached to post section,

must be provided with position-tolerances, larger than locking and assembly tolerances, in x-, y- and z-direction in order to avoid

1. interference with the locking operation of door lock **248** to striker **298** when closing vehicle door **8**;
2. expensive reworking at the assembly line;

3. customer complaints due to disturbing noises [3]. Due to the small distances of overlaying coils denoted as w ≤ 0.2 mm in Fig. 1I, noises such as rattle etc. [3] occur at different oscillations when driving. This condition is comparable with the distances of the mating parts of interengaging assemblies to each other; and RELEVANCE UNCLEAR
4. high reject rate due to different references of coordinate system of vehicle door, finished by two to three suppliers and transported to assembly line, and of vehicle body 20, finished at the assembly line. Huge costs are necessary to computerize design data of vehicle door and structure in data files, which must be evaluated by innovative programs to minimize those position-tolerances and reject rate, however, under the condition of the constant, small contour-clearance.

Noteworthy: A pin, in free connection with a king-size hole, under load can never engage therewith due to large tolerance. A prerequisite for engagement is small tolerances (clearance) of mating parts in x-, y- and z-direction. Examiners of German and European Patent Office as well German and European engineers classify such engagement or connection governed by small tolerances as form-locking connection. Omit

Problem case E1: According to the prior art ~~the first invention of the largest German Corp. having over 100 years of experiences of building luxury cars ref. to DE-PS 1755611 of 06/06/68~~, the taper-formed key 148 and the mating receptacle 198 should be in engagement or form-locking connection ~~("Verbindung" in Claim 1)~~ to ensure energy-transmission from one post section to the other.

Because receptacle 198 and striker 298 are formed together in one piece, an adjustment of receptacle 198 changes the position of striker 298 to the door lock 248 as well as the clearance therebetween, which becomes too large or small. In order to properly latch and lock the vehicle door to vehicle structure the "interengaging" assembly is provided with large tolerance zones, thus violating the condition of the aforementioned feature.

When ~~a luxury vehicle [11] of this Corp. driven on a slippery icy road~~ laterally crashed ~~against a truck~~, the key 148 can disengage ~~disengaged~~ from mating receptacle 198 due to large clearance so the remaining energy totally deforms ~~deformed~~ the vehicle door, whose intrusion can fatally injure the driver.

~~At the end of~~ the 80's the Corp. decided to stop the production of over 20 million "interengaging" assemblies, ~~wherewith over five~~-million vehicles had been equipped within two decades. A problem of two tolerance zones remains ~~unresolved and is very costly~~.

According the prior art shown in ~~to the second invention of the 2nd largest Japanese car Corp. ref. to DE-OS 2162071 of 07/06/72 in~~ Fig. 1A, contour tongues 16.1 should be in engagement with contour grooves 16.2 in order to integrate vehicle door 8, 8B into side rail 18, vehicle roof 17 and B-post section in side collision. Without "interengaging" assembly of the vehicle door and B-post section, the normal operation of vehicle door would be possible if the outer door-contour "abcde" were square. Regarding the recent contour design in Figs. 5 and 18 the line "ab" is generally curve-shaped, line "bc" of front door upwardly inclined ($\beta > 90^0$) or generally curve-shaped and line "bc" of rear door generally S-shaped, so contour grooves 16.2 would interfere with contour tongues 16.1 when closing the vehicle door. Furthermore, to sustain large impact energy it is necessary to reinforce the wide contour groove by an element which, unfortunately, can't be attached to the narrow upper region of door frame 8.17.

~~If this invention were really useful, why had the Corp. not implemented it in each of two sport utility vehicles, whose vehicle structure collapsed and steering column intruded into vehicle body 20, in 40 % offset crash test [1] at low speed of 50 km/h conducted by ADAC?~~

According to the ~~first~~ U.S. Pat. No. 3,819,228 ~~of the largest Italian car Corp. of 06/25/74~~ a bulky "engaging" bolt rigidly attached to a stiff inner panel of vehicle door **8** projects through a hole of a stiff element attached to side rail **18** when the door is in closed position. The problem of large tolerance zones remains unresolved. Moreover, the overall stylish impression spoilt by a bulky "engaging" bolt will, doubtless, not be beneficial to sales. When stepping in or out of the vehicle body while cleaning or repairing, the person can ~~injury~~ ure himself when stumbling over this bulky bolt. When closing the door the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent ~~If this invention were really useful, why had the Corp. not implemented it in the latest compact car, whose vehicle structure collapsed in a real front collision [14] and in 50 % offset crash test [1] at low speed of 55 km/h conducted by Auto Motor und Sport, wherein the femur force of 15100 N would fracture both legs?~~

Problem case **E2**: ~~Both luxury cars [6, 7], a convertible car [10], U.S. Pat. No. 5,518,290 (EP 0642940, DE 4330620) and U.S. Pat. No. 4,676,524, which are described in this Chap., belong to a well-known car manufacturer having HQ in South Germany.~~

~~All four passengers, where one of them was instantly dead at the accident site, were hurled out of a brand-new luxury car [6] colliding into a tree in Wiesbaden City and rolling over.~~ Under load of force F_1 in **Fig.** 10A the deformation of vehicle structure, particularly in y-direction, was larger than that of each vehicle door whose catching hook **148**, rigidly attached to impact beam **1**, **1B**, and door lock **248** were disengaged from the mating recess **198** and striker **298**, all of which were arranged to post section.

unclear what the load force F_1 was larger than

In a real side collision of another ~~luxury~~ car ~~[7] of the same car manufacturer~~ into a tree, great energy totally deformed the vehicle side whose intrusion fatally injured both passengers. Obviously, the lateral force, deviating from the idealized force S_{X1}, could not force catching hook **148** to penetrate into recess **198** in order to define an "interengaging" assembly ~~ref. to U.S. Pat. No. 5,518,290~~.

Both real accidents resulting in severe/fatal injuries verify the shortcomings of any patent valid only for survival chance under load of an idealized force S_{X1}, denoted by arrow **A** in Fig. 1 of U.S. Pat. No. 5,518,290. Taken as given, the mid region of door is secured to the B-post section by the "interengaging" assembly in an "idealized" accident, the upper, lower door frame **8.17, 8.18**, the vehicle roof **17** and side rail **18** are overstressed due to lack of interengaging assemblies. Moreover, problem cases **E3 to E6** remain unresolved.

As exemplified by U.S. Pat. No. 4,676,524, a pair of vertically supporting window-columns, rigidly mounted in both vehicle doors **8** of a convertible car is in abutting, "engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance in rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement ~~ref. to Chap. "Noteworthy"~~,

thereby totally deforming the cowl and pair of window-columns.

The stiffness of ~~such~~ an open roof of a convertible car [10], merely supported by a pair of post sections in force-locking or free connection with one pair of small-size window-columns, is

- very low, thereby resulting in fatality in a real rollover thereof;
- lower than that of a rotatable, stiff rollover bar ~~ref. to U.S. Pat. No. 5,284,360 (DE 4130470 C1) solely implemented in convertible cars of the largest German Corp~~.,
- far lower than that of the closed roof 17 supported by two pairs of post sections ~~of the safest sport car [4] ref. to problem case E6 and~~
- substantially far lower than that of the roof construction according to the invention ref. to DE 4344604 C1 ~~to~~ reinforce the closed roof 17 strongly supported by three pairs of reinforced post sections ~~of the safest, top luxury car [12] whose passengers were instantly dead in a~~ real rollover ~~ref. to problem case E5.~~ Do not reference, describe

Problem case E3: Due to great energy in a real side collision against column 22 of a central barrier in Fig. 10A, 13 on a highway

- large deformation of side rail 18 and rear section ~~of a brand-new two-seater German top model [5] of the largest European car manufacturer~~, opposite to x-direction, caused the disengagement of the driver's less deformed vehicle door 8 from vehicle structure and later on
- the vehicle [5] rolled over three times across the highway and down-hill, thus totally deforming vehicle structure, doors 8, tailgate-door 8T, out of which both rear passengers were hurled, and, alternately, opening and closing both vehicle doors 8, out of which both front passengers were hurled out.

Grass 70 clamped between each post section and each vehicle door 8 in Fig. 8 was an evidence for the alternate opening and closing of both vehicle doors 8 during the rollovers.

In a side collision of a ~~small German~~ car [8] into a tree great energy totally deformed vehicle door 8 whose intrusion severely/fatally injured the passengers.

In a collision of another car [9] into a hill great energy totally deformed the right side rail 18 thus resulting in the disengagement of the door lock 248 and, if provided, interengaging assemblies too and later on totally deforming vehicle structure during rollover. The driver was hurled out of this car.

Problem case E4: In front collision or crash test impact energy deforms, in general, upper door frame/s 8.17 outwards and vehicle roof 17 upwards, thereby creating a gap o in Fig. 10A and preventing front vehicle door/s 8, 8B and/or vehicle roof 17 from transmitting energy to vehicle body 20.

Three different states of deformation are reproduced in three crash tests, conducted by ADAC, of the German vehicles of the same type [18] 40 % offset crashed at the same speed of 50 km/h against

- a very stiff barrier,
- a deformable barrier and
- another vehicle of the same type

because the uniform load, deformable property of two colliding masses, impact condition etc. are different. The gap o having three different sizes in Fig. 8 verifies the above-mentioned thesis of non-transmission of energy.

In side collision impact energy deforms, in general, upper door frame/s 8.17 inwards thereby inflicting injuries on head.

Problem case **E5**: During rollover of the top luxury car [12] of the largest German Corp. several times, impact energy totally deformed vehicle roof **17** whose intrusion severely or fatally injured both front passengers, whose heads were, definitely, crushed by falsely deployed airbags, and the remaining energy totally deformed vehicle body **20** and doors **8, 8B, 8T, 8x**.

Problem case **E6**: Responsive to problem case **E**, a clamping assembly ("Verkrallungspaar"; "Türverkrallung" = door clamping. "verkrallen" = to clamp) of EP 0423465A1 illustrated in **Fig. 1B** comprises

- a stiff hook of stiff ledge **25.2** rigidly mounted to lower door frame **8.18** and
- a thin mating panel of a stiff plate **25.1**, rigidly attached along sill rail **18**, serving as a site of predetermined fracture.

In excess of predetermined value in real side accident, the mating parts **25.1, 25.2** of interengaging assemblies are in the state of clamping to ensure the permanent engagement of lower door frame **8.18** with sill rail **18** in order to resolve the problem of passenger ejection. The proprietor, a German sport-car manufacturer, has built, beyond doubt, the safest sport cars in the world. Load cases **I to III, V** and problem cases **E2 to E5** remain unresolved. Furthermore, there is no space to house both mating parts **25.1, 25.2** in vehicle roof **17** and upper door frame **8.17** subjected to lateral load F_o in real accident. The lack of interengaging assemblies became obvious in the rollover of its classic, very expensive sport car [4], which plunged seven meter downwards and crashed with vehicle roof **17** at a lower

E16

E16

Dear Mr Morrow, 11/04/99

I amended the error "*minimum tolerances*" in Claim 3 pp. 18/col. 22 ~~to~~ "*permissible tolerances*" and added the symbol „$-x_n$", „$-y_n$" and „y_p" ~~in Fig. 15~~ for the sake of better understanding the description. There is a BIG DIFFERENCE between the US-Description of the Preferred Embodiments and the non-US Description. Frankly to say, I was not able to understand the reason for narration till receiving your fax, wherein the explanation is found. I wish to thank you therefor and for the coming amendments/suggestions.

Please correct my work subdivided due to the limited RAM and faxed to you. Should I later on mail you a complete copy *with* numeral references or *without*? Thank you for your interest and help.

kind regards.

Go

phone/fax +49 6126 8949

INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

I did not

it was

WRONG

This is a continuation-in-part application of co-pending international application number PCT/DE 96/02120 (WO 97/18984, EP 0869878 B1) filed Nov. 7, 1996 and claiming the priority of DE 195 43 706 A1 filed Nov. 17, 1995. ~~is revised and refiled~~.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all post sections (pillar portions) and the flanges of door apertures of a vehicle body thereby distributing energy to all those vehicle members, lowering stress thereof,

preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) or rollover.

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*series-connected doors*"	doors of one vehicle side are series-connected
"*girder*"	panel, shell, beam etc. according to FEM and Technical Mechanics
"*window-guide elements*" of vehicle doors	window-guides **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicle members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & post section/s, vehicle door & vehicle door in engagement

in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicle members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type U2, one of four types shown in **Fig.** 13. However, all these conventional configurations do not take into account the failure of passenger protection due to the following problem cases in conjunction with disengagement of the mating parts of interengaging assemblies from each other in the event of all types of real collision (any real collision) or real rollover:

A Load cases **I to V** according to Technical Mechanics/FEM in real front, side and rear collision;

B Wrong assumption of the prior art for the purpose of idealizing a general side energy S or S_1 to a single energy S_x or S_{x1};

C Analogy between the state of non-contact and disengagement;

D Constant, small contour-clearance and assembly tolerance zones;

E Large clearances of interengaging assemblies;

E1 The first inventions of interengaging assemblies, huge production costs and fatal injury in real collision due to large clearances;

E2 Large deformation of vehicle structure or door **8. 8B** in real collision;

E3 Large deformation of side rail **18** in real collision;

E4 Large deformation of upper door frame **8.17** and vehicle roof **17** in real collision;

E5 Intrusion of vehicle roof **17** in vehicle body **20** on real rollovers; and

E6 Clamping assemblies or adjustable interengaging assemblies to resolve problem case **E**.

Problem case A: In order to idealize an impact force $2F_1$, shown in **Fig.** 10A, imposed on a vehicle structure the following assumptions must be specified:

- let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.

Load case **I** in z-y plane in **Fig.** 5: The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all post sections, series-connected doors **8, 8B** reinforced by impact elements and interengaging assemblies of those doors and post sections, is subjected to the bending moment along the y-axis.

Load case **II** in z-x plane in **Fig.** 6: The force V exerts bending moment M_{zx} along the x-axis and rotating moment $M_y = V*b$ about the y-axis acts as torsional moment along the vehicle side.

Load case **III** in x-y plane in **Fig.** 7: The A-post section is under load of rotating moment $M_{xy} = -H*b$. The vehicle side is subjected to bending moment M_{xy} along the y-axis and buckling force H.

Subjected to the total stress of bending moments M_{zx}, M_{xy}, M_{zy}, buckling force H and torsional moments M_z, M_y in the load cases **I to III**, the vehicle side, shown in **Fig.** 8, is deformed in real front collision.

By reversibly arranging the series-connected doors **8, 8B** the same load cases are obtained for real rear collision.

Load case **IV** in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.

Load case **V** in z-x plane in **Fig.** 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column **22**, shown in **Fig.** 10A, 13, the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in load cases **IV** and **V**.

Problem case **B**: The majority of the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases **IV** and **V** be idealized to a lateral energy S_x, shown in **Fig.** 9, or S_{x1}, shown in **Fig.** 10A, imposing on the *centre* of vehicle door, illustrated as collision type U1, shown in **Fig.** 13, despite four collision types U1 to U4 and the collision type U2 having the highest percentage of severe and fatal injuries. Nevertheless, car manufacturers and suppliers world-wide have adopted this idealized S_x or S_{x1} in inventions e.g. U.S. Pat. No. 4,307,911, U.S. Pat. No. 5,806,917, U.S. Pat. No. 5,518,290, whose shortcomings are mentioned in the following problem case **E2**.

Problem case **C**: Ref. to **Figs.** 11, 12 both end coils of compression-coil spring **19** are guided by two spring seats **19.1**. Their utmost outer nodes KN_i and KN_{End} (not drawn) rest against both stops **19.3**, where i represents the number of coils. To survey the rolling behaviour of end coil **19** on the lower spring seat **19.1** the end coil is idealized in elements by supporting springs in reference to the nodes and by the threshold value of the distance in the "state of rolling" s < 0.1 mm. **Fig.** 12 illustrates

the rolling behaviour in regard to the FEM data and test results marked with M in dependence on F_z = -790, -1000 and -3000 N:

- According to test results KN_2 to KN_5 roll on the spring seat at F_z = -790 N, but in the state of non-contact at F_z = -1000 and -3000 N.
- According to FEM data the nodes in the following states are in dependence on F_z:

F_z	State of contact	State of rolling
-100	KN_1, KN_{15}, KN_{17}	KN_1 to KN_3, KN_{10} to KN_{18}
-250	KN_1, KN_{19}, KN_{20}	KN_1, KN_{15} to KN_{23}
-1415	KN_1, KN_{17}, KN_{19}, KN_{20}, KN_{30}, KN_{31}, KN_{33}, KN_{34}	KN_1, KN_{15} to KN_{35}

The state of contact (engagement) of mating parts of interengaging assemblies, idealized by nodes of the rolling end coils and mating elements of the spring, can be transformed into the state of disengagement, when the force increases.

Problem case **D**: Recently in automotive industry, great efforts have been made to achieve (finish) a constant (uniform), small contour clearance between the outer door-contour "abcde" of vehicle door **8, 8B** and the door aperture of vehicle body **20**, shown in **Fig.** 5, in order to minimize flow noise and, particularly, to achieve sales success in co-operation with an overall impression of attractive design. In the state of assembly the contour clearance e.g. of AUDI ® vehicles is only 2.5 mm and of VW Passat ® 3.5 mm.

In order to meet the above-mentioned goal and to avoid rework or reject rate large assembly tolerances between the outer door-contour and the door aperture (opening) of vehicle body 20 must be designed.

Problem case **E**: The door lock **248**, rigidly attached to vehicle door **8**, and the striker **298**, rigidly attached to post section illustrated as B-post section in **Fig.** 10A of U.S.

Pat. No 4,307,911 representing the prior art, is provided with locking clearances in x-, y- and z-direction, thus ensuring the state of door locking and the normal operation of vehicle door. For the purpose of preserving the constant, small contour-clearance,

- the position D_a to D_c of each key **128a to 128c**, rigidly attached to vehicle door **8**, and the position S_a to S_c of mating receptacle **158a to 158c**, rigidly attached to lower stiff panel **156** of side rail **18**;
- the position D_n of key **148**, rigidly attached to vehicle door **8**, and the position B_n of mating receptacle **198**, rigidly attached to post section,

must be provided with position-tolerances, larger than locking and assembly tolerances, in x-, y- and z-direction in order to avoid

1. interference with the locking operation of door lock **248** to striker **298** when closing vehicle door **8**;
2. expensive reworking at the assembly line;
3. customer complaints due to disturbing noises associated with the small distances of overlaying coils, representing the mating parts of interengaging assemblies, denoted as $w \leq 0.2$ mm, shown in **Fig. 11**; and
4. high reject rate due to different references of coordinate system of vehicle door, finished by two to three suppliers and transported to assembly line, and of vehicle body **20**, finished at the assembly line. Huge costs are necessary to computerize design data of vehicle door and structure in data files, which must be evaluated by innovative programs to minimize those position-tolerances and reject rate, however, under the condition of the constant, small contour-clearance.

Problem case **E1**: According to the prior art the taper-formed key **148** and the mating receptacle **198** should be in engagement or form-locking connection to ensure energy-transmission from one post section to the other.

Because receptacle **198** and striker **298** are formed together in one piece, an adjustment of receptacle **198** changes the position of striker **298** to the door lock **248** as well as the clearance therebetween, which becomes too large or small. In order to properly latch and lock the vehicle door to vehicle structure the "interengaging" assembly is provided with large tolerance zones, thus violating the condition of the aforementioned feature.

When a vehicle is laterally crashed by a truck, the key **148** can disengage from mating receptacle **198** due to large clearance so the remaining energy totally deforms the vehicle door, whose intrusion can fatally injure the driver.

According to the prior art shown in **Fig.** 1A, contour tongues **16.1** should be in engagement with contour grooves **16.2** in order to integrate vehicle door **8, 8B** into side rail **18,** vehicle roof **17** and B-post section in side collision. Without "interengaging" assembly of the vehicle door and B-post section, the normal operation of vehicle door would be possible if the outer door-contour "abcde" were square. Regarding the recent contour design, shown in **Figs.** 5 and 18, the line "ab" is generally curve-shaped, line "bc" of front door upwardly inclined ($\beta > 90^0$) or generally curve-shaped and line "bc" of rear door generally S-shaped, so contour grooves **16.2** would interfere with contour tongues **16.1** when closing the vehicle door. Furthermore, to sustain large impact energy it is necessary to reinforce the wide contour groove by an element which, unfortunately, can't be attached to the narrow upper region of door frame **8.17**.

According to the U.S. Pat. No. 3,819,228 a bulky "engaging" bolt rigidly attached to a stiff inner panel of vehicle door **8** projects through a hole of a stiff element attached to side rail **18** when the door is in closed position. The problem of large tolerance zones remains unresolved. Moreover, the overall stylish impression spoilt by a bulky "engaging" bolt will, doubtless, not be beneficial to sales. When stepping in or

out of the vehicle body while cleaning or repairing, the person can injure himself when stumbling over this bulky bolt. When closing the door the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent.

Problem case **E2**: Under the load of force F_1, shown in **Fig.** 10A, in an approx. 30^0 inclined, offset front collision against another car the vehicle structure, totally deformed, is deflected, in great extent, in the opposite x-direction and in the y-direction thus resulting in disengagement of the catching hook **148**, rigidly attached to the impact beam **1, 1B** of driver-door, and the door lock **248** from the mating recess **198** and striker **298**, all of which are rigidly attached to the B-post section, respectively, in association with the reduction of the distance between the A- and B-post section from 860 mm to 490 mm in the y-direction and the collapse of passenger protection. Later on, the remaining energy totally deforms the driver-door too. If the car rolls over, the driver would be ejected thereout.

In a real side collision of another car into a tree, great energy totally deformed the vehicle side whose intrusion fatally injured both passengers. Obviously, the lateral force, deviating from the idealized force S_{X1}, could not force catching hook **148** to penetrate into recess **198** in order to define an "interengaging" assembly.

Both real accidents resulting in severe/fatal injuries verify the shortcomings of any patent valid only for survival chance under load of an idealized force S_{X1}, denoted by arrow A in Fig. 1 of U.S. Pat. No. 5,518,290. Taken as given, the mid region of door is secured to the B-post section by the "interengaging" assembly in an "idealized" accident, the upper, lower door frame **8.17, 8.18**, the vehicle roof **17** and side rail **18** are overstressed due to lack of interengaging assemblies. Moreover, problem cases **E3** to E6 remain unresolved.

As exemplified by U.S. Pat. No. 4,676,524, a pair of vertically supporting window-columns, rigidly mounted in both vehicle doors **8** of a convertible car is in abutting,

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

thereby totally deforming the cowl and pair of window-columns.

The stiffness of an open roof of a convertible car, merely supported by a pair of post sections in force-locking or free connection with one pair of small-size window-columns, is

- very low, thereby resulting in fatality on a real rollover thereof;
- lower than that of a rotatable, stiff rollover bar;
- far lower than that of the closed roof **17** supported by two pairs of post sections and
- substantially far lower than that of the closed roof **17** strongly supported by three pairs of reinforced post sections.

Problem case **E3**: Due to great energy in a real side collision against column **22** of a central barrier, shown in **Fig.** 10A, 13, on a highway

- large deformation of side rail **18** and rear section of a vehicle, opposite to x-direction, caused the disengagement of the driver's less deformed vehicle door **8** from vehicle structure and later on
- the vehicle rolled over three times across the highway and down-hill, thus totally deforming vehicle structure, doors **8**, tailgate-door **8T**, out of which both rear passengers were hurled, and, alternately, opening and closing both vehicle doors **8**, out of which both front passengers were hurled out.

Grass 70 clamped between each post section and each vehicle door 8, shown in **Fig.** 8, was an evidence for the alternate opening and closing of both vehicle doors **8** during the rollovers.

In a side collision of a car into a tree great energy totally deformed vehicle door **8** whose intrusion severely/fatally injured the passengers.

In a collision of another car into a hill great energy totally deformed the right side rail **18** thus resulting in the disengagement of the door lock **248** and, if provided, interengaging assemblies too and later on totally deforming vehicle structure during rollover. The driver was hurled out of this car.

Problem case **E4**: In front collision or crash test impact energy deforms, in general, upper door frame/s **8.17** outwards and vehicle roof **17** upwards, thereby creating a gap „o", shown in **Fig.** 8, and preventing front vehicle door/s **8, 8B** and/or vehicle roof **17** from transmitting energy to vehicle body **20**.

Three different states of deformation are reproduced in three crash tests, conducted by ADAC, of the German vehicles of the same type 40 % offset crashed at the same speed of 50 km/h against

- a very stiff barrier,
- a deformable barrier and

– another vehicle of the same type

because the uniform load, deformable property of two colliding masses, impact condition etc. are different. The gap „o " in three different sizes, shown in **Fig.** 8, verifies the above-mentioned thesis of non-transmission of energy.

In side collision impact energy deforms, in general, upper door frame/s **8.17** inwards thereby inflicting injuries on head.

Problem case **E5**: During the rollover of a car, impact energy totally deformed vehicle roof **17** whose intrusion severely or fatally injured both front passengers, whose heads were, definitely, crushed by falsely deployed airbags, and the remaining energy totally deformed vehicle body **20** and doors **8, 8B, 8T, 8x**.

Problem case **E6**: Responsive to problem case **E**, a clamping assembly illustrated in **Fig.** 1B comprises

– a stiff hook of stiff ledge **25.2** rigidly mounted to lower door frame **8.18** and

– a thin mating panel of a stiff plate **25.1**, rigidly attached along sill rail **18**, serving as a site of predetermined fracture.

In excess of predetermined value in real side accident, the mating parts **25.1, 25.2** of interengaging assemblies are in the state of clamping to ensure the permanent engagement of lower door frame **8.18** with sill rail **18** in order to resolve the problem of passenger ejection. Load cases **I to III, V** and problem cases **E2 to E5** remain unresolved. Furthermore, there is no space to house both mating parts **25.1, 25.2** in vehicle roof **17** and upper door frame **8.17** subjected to lateral load F_o in real accident. The lack of interengaging assemblies became obvious on the rollover of a sport car, which plunged seven meter downwards and crashed with vehicle roof **17** at a lower level of an underpass in Wiesbaden City thus totally deforming vehicle roof **17**, body **20** and both upper door frames **8.17** during rollover, where the remaining energy was

transmitted through both head rests, integrated into the respective seatbacks, to the vehicle floor, thereby reducing the AIS of both passengers. AIS is an international acronym of Abbreviated Injury Severity ranging from 0 (no injury) to 6 (fatality).

Responsive to problem case **E**, adjustable and/or latching mechanisms are provided for interengaging assemblies, whose adjustable and/or latchable keys are bolted to the B- or C-post section, facing the termini of both reinforcing beams **1, 7** or **1B, 7B**, and whose mating receptacles are arranged thereto. Both plates **5.1, 5.2** of each hinge of vehicle door are provided with a rivet serving as key and an oblong mating hole. Owing to this feature load cases **I to IV** are resolved, but load case **V** and problem cases **E3 to E5** remain unresolved.

Evidently, due to load cases **I to V** and all problem cases **B, E, E1 to E5** "interengaging" assemblies of the remaining prior art are unsuitable for the purpose of energy-transmission and distribution by means of the integration of vehicle doors **8, 8B, 8T** into the vehicle body **20**, in conjunction with five tolerance zones proposed by U.S. Pat. No. 5,297,841, U.S. Pat. No. 4,307,911 and eight tolerance zones proposed by U.S. Pat. No. 5,806,917.

SUMMARY OF THE INVENTION

Accordingly, the principle object of the present invention is to overcome the deficiencies of the prior art by providing engagement for interengaging assembly having large clearances, which are necessary in car manufacturing and door assembly, in order

– to protect passengers against ejection from the vehicle body and/or intrusion of vehicle member and

– to increase the vehicular stiffness

in the event of any collision and/or rollover. These interengaging assembly are arranged to the corresponding vehicular couples (vehicle member & mating vehicle member).

This principle and other objects of the present invention are accomplished by the following features (proposals):

– minimum tolerances by installing and adjusting the engaging keys from outside to tightly mate the receptacles thereby ensuring the connection of the doors with all vehicle members of vehicle body 20 such as post sections, vehicle roof 17, flange 21, a pair of side rails 18, fastened to vehicle floor, in any collision and/or on rollover;

– interengaging assemblies with adjusting mechanisms such as holes & keys **15.1** to **15.5a**, **15.7**, **15.8**, hooks **15.6** & reinforcing rod **17.1d** and holes & keys **30** to **37**, shown in **Fig.** 1, 3, 3A, 4, 4A and 14 to 18;

– window-guide elements to accommodate the engaging parts;

– space-saving, inexpensive design for engaging parts;

– arrangement of interengaging assemblies of a vehicular couple in at least two operating planes thus making the strict restriction of minimum tolerances less significant;

– arrangement of an U-shaped extension member having keys in the common post section of the series-connected vehicle doors, whose holes mate with the keys to ensure the engagement owing to constrained deformation thereof.

Despite the failure of the prior art in the event of real side collision any modification and extra design for survival chance in real collision and/or on rollover will generate costs, R&D expenses and weight due to the use of other inventions.

Summary of the advantages of the present invention:

A) saving labour-time by installing and adjusting engaging parts from outside the vehicle body.

B) low reject rate.

C) space-saving, inexpensive design.

D) dissimilar operating planes or at least two operating planes for each vehicular couple to ensure the engagement of its interengaging assemblies in association with energy absorption due to load cases in three different planes. **Figs.** 14 to 18 illustrate *a single vehicular couple*: window-guide element & B-post section with the interengaging assemblies: keys **34** & holes in z-x plane acting as the first operating plane, however, interengaging assemblies: keys **32, 33** & holes in z-y plane acting as the second operating plane. The specification is changed from the minimum tolerances of "narrow" to permissible tolerances of "far less narrow", thus cutting costs and time associated with less adjustment work to reduce large clearances thereto. This feature of dissimilar operating planes is applicable too for both interengaging assemblies: holes & **15.1, 15.2a** and **15.2, 15.3** and **15.4a, 15.5** etc., shown in **Fig.** 3. A row of the same keys is operative in dissimilar operating planes by arranging a number of the same keys **15.1** to the generally inclined A-post section or of keys **33** to the generally inclined B-post section. In reference to the global xyz coordinate system the key **15.2a** & hole is operative in an inclined plane.

Because the hinge bolts of the front and rear doors have an operating direction in z-axis the arrangement of interengaging assemblies: holes & keys **31, 36** to one

operating plane is sufficient. However, any additional arrangement of holes & keys **30, 35** improves the engagement of vehicle mating parts and substantially decreases severe/fatal injuries in any real collision.

E) minimizing the R&D work by reducing FEM calculations, crash tests and by saving material due to the arrangement of interengaging assembly in different operating planes.

F) passenger protection for all collisions by a single construction, manufacturing, testing expenditure, assembly and material supply.

G) exploitation of the flange **21, 21T, 21h, 21x** of vehicle body **20** provided with sound-proofing material **21.10**, shown in **Figs.** 1, 17, 18, due to the sites to accommodate keys and the continuous stress curve. The enlargement of the flange to a limited extent neither impairs the overall stylish impression nor obstructs the passenger from ingress into or engress from the passenger compartment. Those edges (regions) of all post sections are defined by the dotted lines "a1", "b1", "b2" and "c1".

H) overall stylish impression. As substitutes of the bulky bolt ref. to U.S. Pat. No 3,819,228 small-size parts can be distributed in inconspicuous manner along the window-guide elements as well as flange, thus substantially ensuring the engagement of vehicular couple whilst lowering stress. Due to this feature it is possible to arrange the following keys:

- **30, 32, 35, 37** to the respective flange **21** of vehicle body **20**. In contrary to U.S. Pat. No. 3,819,228, this feature won't endanger passenger when stepping in or out, furthermore, more useful for passenger protection in side collision, particularly, according to collision types U1 and U2, shown in **Fig.** 13, as well as in front collision.

- **15.2a, 15.2, 15.7** e.g. with screws M4 to the narrow window-guide element **6.3, 6.3B** of upper door frame **8.17** to resolve the problem of the large, stiff contour groove of the prior art.
- **33, 34, 36** to the respective window-guide elements **6, 6B** and elements **6.7, 6.8** in engagement with the reinforced B-post section in two to three operating planes without obstructing the operation of the seat belt **26.1**, shown in **Fig.** 15. The fact, that no contact is made during the opening operation of series-connected vehicle doors, is demonstrated by the trajectories of both outer points of the washer and of the door edges drawn with dotted lines.
- **31** to the respective window-guide elements **6** and elements **6.6a** in engagement with the reinforced A-post section.

I) less stress to solve the problem of total deformation. By means of arrangement of interengaging assemblies of each vehicular couple in multi-operating planes and increase of vehicular couples comprising vehicle door & vehicle roof **17**, vehicle door & side rail **18**, vehicle door & post section/s and vehicle door & vehicle body **20** more vehicle members in compound construction are involved in energy absorption in different load cases in the event of any collision and/or rollover. In co-operation with another prior art the structural stiffness reaches the maximum. Beyond doubt, the advantage of keys *2.1, 5.6* & mating holes is due to the further exploitation of the very stiff impact beams **1, 7** to house the corresponding parts. Because the other vehicular couples comprising such as vehicle door & side rail and vehicle door & vehicle roof are not equipped with interengaging assemblies this *single* arrangement of one vehicular couple in mid region of door is insufficient in the event of any collision and/or rollover, therefore endangering the passengers in the following state of deformation

- intrusion of vehicle roof **17** into the vehicle body and of upper door frame **8.17**, thus squashing the passengers and
- buckling of the upper portion of the A-post section, total deformation of upper door frame **8.17**, buckling of vehicle roof **17** and buckling of side rails **18**, shown in **Fig.** 8.

In order to avoid the above-mentioned state a number of holes or keys **30 to 37** is arranged to the flange **21** *above*, *below* of the impact beams **1, 7** and *therebetween*. When the *non-adjustable* rivets *5.6* of the door hinges in x-z operating plane are replaced by a number of interengaging assemblies **15.1, 15.2a, 15.4, 30, 31** in numerous operating planes, the total stress of the vehicular couples: A-post section & vehicle door along the z-axis is lower owing to stress distribution, thereby preventing, to a certain extent, the A-post section and vehicle door from total deformation and gap „o", shown in **Fig.** 8.

J) measures against passenger ejection and total deformation of the vehicle members, whereby vehicle doors are not or less deformed, in real accident ref. to problem cases **E2 to E4**, which can solely be solved by engagement of the following interengaging assemblies governed by permissible tolerances:

- holes & keys **15.3, 15.3a, 15.5a, 15.5** owing to U-shaped extension members **17.3, 18.3**, whose deformation causes a constrained deformation of the series-connected vehicle doors, vehicle roof and side rails;
- holes & keys **32, 33, 34, 30, 15.2, 15.4a** of the vehicular couple comprising vehicle door & B-post section in four operating planes; *and/or*
- hooks **15.6** & reinforcing rod **17.1d** of both vehicular couples comprising series-connected vehicle doors & side rail and series-connected vehicle doors & vehicle roof, so that the deformation of the side rail and vehicle roof causes a constrained deformation of the series-connected vehicle doors; and

by *energy transmission* into the other vehicle side by means of transverse girders **17.2, 17.2b, 17.2c, 17.2d, 18.2** of vehicle roof, side rails and all post sections facing each other, thus distributing the energy thereto.

K) passenger protection by engagement of vehicle couples in rear collision. Door detachment in rear collision occurred due to the lack of door hinges and interengaging assemblies. For the purpose of connection of vehicular members to each other the engagement of rear door **8B** with the C-post section is improved by rigidly arranging

- element **6.5C,** adapted to the outer door-contour and having holes to receive mating keys **37**, shown in **Figs.** 14, 18, to the door frame of rear door; and
- keys **33, 34** to window-guide element **6B**.

The features of vehicle door are, doubtless, suitable for tailgate door **8T**, sliding side door, liftgate door cargo door, trunk cover **8x**, hood **8h**, series-connected doors, e.g. three vehicle doors with four post sections of large van.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments, other advantages and features of the present invention will be described in the accompanying drawings with reference to the xyz global coordinate system::

Fig. 1 is a side view of vehicle side, body, impact beams, keys, hooks, window-guides and window-guide elements (reinforcing elements).

Fig. 1A is a cross-sectional view of a vehicle door engaging with a roof and side rail ref. to DE-OS 2162071 in side collision.

Fig. 1B is a cross-sectional view of a vehicle door engaging with a side rail ref. to EP 0423465 A1 in side collision.

Fig. 2 is a side view of an U-shaped window-guide element, the position of keys **15.7, 15.8** and of an additional window-guide element **6.4, 6.4B**.

Fig. 2A is a side view of an U-shaped window-guide element, the position of keys **15.7**.

Fig. 3 is a perspective view of a front stiff door frame with both window-guides, both respective window-guide elements and interengaging assemblies of the 1st embodiment.

Fig. 3A is a cross-sectional view of a key equipped with an adjusting mechanism.

Fig. 4 is a perspective view of interengaging assembly hooks & reinforcing rod of the 2nd embodiment.

Fig. 4A is a cross-sectional view of the reinforcing rod and the mating hook equipped with an adjusting mechanism.

Fig. 5 illustrates a load case I in z-y plane in front collision of vehicle.

Fig. 6 illustrates a load case II in z-x plane in front collision.

Fig. 7 illustrates a load case III in x-y plane in front collision.

Fig. 8 is a state of total deformation of vehicle at displacement v in front collision.

Fig. 9 illustrates a load case IV in x-y plane in side collision of vehicle.

Fig. 10 illustrates a load case V in z-x plane in side collision.

Fig. 10A illustrates the mating parts of interengaging assemblies ref. to U.S. Pat. No 4,307,911, both mating parts of a door lock, the general force F_1 or S_1 in the event of front or side collision and a highway column.

Fig. 11 is a view of a compression-coil spring on a lower spring seat.

Fig. 12 illustrates the projection of the end coil and spring seat in a plane, the test results and FEM data of an end coil rolling on the lower spring seat in dependence on load.

Fig. 13 illustrates four collision types U1 to U4 ref. to the research work of Institute of Vehicle Safety, a Dept. of German Insurers Association, and a highway column.

Fig. 14 is a perspective view of interengaging assemblies of the 3rd embodiment comprising a stiff front door frame having a single window-guide element and a stiff rear door frame having a single window-guide element to engage with the post sections and flange of vehicle body.

Fig. 15 is a cross-sectional view of the series-connected doors in engagement with the A-, B-post section and of the vehicle body along the line D-D in **Fig.** 14.

Fig. 16 is a side view of the series-connected stiff door frames without window pane in engagement with the B-post section according to arrow E in **Fig.** 14.

Fig. 17 is a perspective view of interengaging assemblies of the 4th embodiment comprising a stiff front door frame having a single window-guide element in engagement with the flange of vehicle body.

Fig. 18 is a side view of the flange of vehicle body provided with keys.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Ref. to **Fig.** 3 the scope of the application of the window-guide elements of vehicle door is extended to accommodate the keys of interengaging assemblies, whose mating receptacles are arranged to any (A-, B-, C- or D-) post section, flange of vehicle body, vehicle roof and/or side rail. The positions of keys and mating receptacles may be interchanged if desired.

According to the prior art a stiff door frame of vehicle door can be assembled, without door girder and reinforcing elements, from at least two impact beams provided with interengaging assemblies and at least one window-guide element **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**. As is customary, the window-guides

6.1, 6.2, 6.1B, 6.2B, shown in **Figs.** 1 and 3, are made from U-shaped thin panel. As *reinforcing elements* the window-guide elements are of higher-grade tensile strength **6.1a, 6.2a, 6.1aB, 6.2aB** to:

- reinforce the U-shaped window-guides of metal sheets,
- receive parts such as hooks, keys and/or holes and
- receive elements **6.5, 6.5B, 6.6a, 6, 6b, 6.7a, 6.7b, 6.8, 6.9** (not drawn) as structural element with higher-grade tensile strength.

The elements **6.8, 6.9** ref. to **Fig.** 14 are fixedly attached to the front faces of both impact beams **1B, 7B** and window-guide element **6B**, the elements **6.6b, 6.7b** to window-guide element **6** and impact beam **7** and the elements **6.6a, 6.7a** to window-guide element **6** and between both impact beams **1, 7**.

Both window-guide elements are replaceable by an U-shaped stiff window-guide element **6, 6B**, shown in **Figs.** 2, 2A, 14 to 17. Less stiff elements **6.3, 6.3B** are normally made of panel. Alternately, very stiff window-guide element **6.3, 6.3B** serves to receive the window pane and keys **15.7**.

Window-guide element **6, 6B** provided with window-guide element **6.3, 6.3B** in the door cavity, shown in **Fig.** 2A, have open ends. To maximize the stiffness of window-guide element **6, 6B** both ends are rigidly connected to each other by window-guide element **6.4, 6.4B** in the door cavity, shown in **Figs.** 2, 14 to 17:

- after the window pane has been inserted, *or*
- by having flat profile, shown in **Fig.** 17, for the purpose of receiving window pane 60, **60B**, shown in **Fig.** 15. Later on, this window pane must be secured against falling down by protective parts.

The window-guide element **6.4, 6.4B** is useful for the accommodation of keys **15.8**. If extraneous weight is not that important for heavy cars, trucks and vans, the window-

guide element fastened to the impact beams serves as members of door frame to receive keys while the window-guides of panel guides and receives the window pane.

One of the solutions for the problem case **E4** and energy-distribution to both post sections, door **8, 8B**, roof **17** and side rail **18** as well as from one vehicle side to the other vehicle side is featured in the 1st embodiment by arranging

- key **15.1** to a reinforcing element of the L-shaped A-post section, welded to reinforcing panel **17.1c** arranged along the vehicle roof and to transverse girder **17.2d** of both facing A-post sections of both vehicle sides, and the mating oblong hole to window-guide element **6.1a**;
- keys **15.1** to reinforced A-post section and the mating oblong holes to window-guide element **6.1a**;
- keys **15.2** to window-guide elements **6.1a, 6.2a** and the mating holes to reinforcing panel **17.1a** arranged along the vehicle roof; and
- keys **15.4** to the reinforcing plate of reinforcing panel **18.1** arranged along the side rail, and the mating holes to window-guide elements **6.1a, 6.2a**.

In case of large-sized door it is recommended to arrange additional keys **15.2, 15.4** to window-guide element **6.3, 6.4** and the mating holes to the reinforced vehicle roof and the reinforced side rail, respectively.

Ref. to **Fig.** 4 the 2nd embodiment consists of an interengaging assembly, the hooks of which are attached to two window-guide elements of each vehicle door and the mating rod to the vehicle roof, post sections of the door or all doors. The rod serves to reinforce the vehicle roof, sustain impact force and aid positioning on assembly, thus cutting costs. However, this embodiment needs space, which is available in large cars, trucks and vans. This embodiment is suited too for another vehicular couple comprising vehicle door/s & side rail.

The interengaging hooks **15.6** are bolted to window-guide elements **6.1a, 6.2a, 6.1aB, 6.2aB** and the mating reinforcing rod **17.1d** is arranged along the vehicle roof **17** and/or side rail **18**. When at least one pair of rods is welded to transverse girders **17.2e, 17.2f, 17.2g** of both A-, B- and C-post sections, energy can be distributed from one vehicle side to the other vehicle side in side collision, from the front to rear vehicle section of vehicle body **20** in front collision, from the rear to front vehicle section of vehicle body **20** in rear collision or to all parts of vehicle body **20** on rollover.

Ref. to **Figs.** 14, 17, 18 the 3rd embodiment consists of interengaging assemblies **30 & 6.5, 35 & 6.5B** and other interengaging assemblies **32 & 6.9, 37 & 6.9B (6.9, 6.9B** similar to **6.5**), **37 & 6.5C** for the purpose of avoiding large deformation of the edges of each door and of saving costs by exploiting the flange **21** of vehicle body **20** and the enlarged flange defined by the dotted lines "a1", "b1", "b2" and "c1". The keys **30, 32, 35, 37** are bolted to the respective reinforcing elements **21.1 to 21.5, 21.1B to 21.5B** of the flange **21** of vehicle body **20** and the corresponding holes are arranged to the housings **6.5, 6.5B** and/or auxiliary element **6.5C**, all of which are rigidly attached to the respective window-guide elements **6, 6B**, the respective elements **6.6b, 6.7b, 6.8, 6.9** (not drawn because of the similarity to **6.7b**) and/or the respective impact beams **1, 1B, 7, 7B**. The reinforcing element **21.5B** is welded to the flange and rear wheel case. The same reinforcing method can be employed to arrange a similar element **21.1** to the flange and the front wheel case.

Stiff door hinges in co-operation with impact beams **1, 7, 1B, 7B** and interengaging assemblies transmit forces of load case **I** from the front to rear vehicle section of vehicle body **20** in front collision. There is no door hinges to connect the rear door to the C-post section. To improve energy transmission from the rear to front vehicle

section of vehicle body **20** in rear collision, an auxiliary element **6.5C** is attached to the impact beams **1B, 7B**.

Instead of the bulky "engaging" bolt ref. to U.S. Pat. No. 3,819,228 these keys, configured in small size and distributed along the flange, neither spoil the overall design nor injure persons stepping in or out of the vehicle body.

The Technical Mechanical Method of constrained deformation is applied to secure the engagement of all vehicle parts with each other in the event of accident and to distribute impact energy thereto by means of two U-shaped extension members **17.3, 18.3**, located in common post section ref. to **Fig.** 3, whose keys **15.3, 15.3a, 15.5, 15.5a** are engaged with the mating apertures, arranged to the corresponding window-guide elements **6.2a, 6.1aB** of series-connected doors **8, 8B**, when doors are closed. This feature of the 4th embodiment prevents the disengagement of interengaging assemblies due to large inward deflection of vehicle body **20**, vehicle roof **17** or side rail **18**, above-mentioned in the problem case **E2, E3** or **E5**, when the doors are subjected to little or no deformation. As connection element of the common post section and the vehicle roof, this U-shaped extension member **17.3** is welded to reinforcing panel **17.1b**, arranged along vehicle roof **17**, and to transverse girder **17.2c** of both facing common post sections of the vehicle sides. As connection element of the common post section and the vehicle floor this U-shaped extension member **18.3** is welded to reinforcing panel **18.1b**, arranged along the vehicle floor, and to transverse girder **18.2** of both facing common post sections of the vehicle sides. The belt case **26** can be housed in the U-shaped extension member **18.3**.

Due to the arc-travel path of the door about the mutual axis of door hinges the mating surfaces of key and receptacle of each interengaging assembly, proposed by U.S. Pat. No. 5,806,917, are configured in four tapered forms or two curved and two tapered forms, thus yielding eight tolerance zones, high manufacturing and assembling

costs as well as making tight engagement impossible resulting in door detachment in accident. To resolve these problems straight (non-curved, non-inclined or non-tapered) engaging surfaces are proposed for key and receptacle. The purpose of assembling and adjusting any key, shown in **Figs.** 3, 3A, 4 and 4A, from outside of the vehicle body **20** is to substantially cut labour time and costs. Costs can be enormously lowered by using mechanical connecting parts, particularly standard parts like washer (ref. to DIN 125), hexagon socket head screw (ref. to DIN 912) etc. With the exception of **15.4a** each key **15.1 to 15.5a, 15.7, 15.8, 30 to 37** comprises a screw **15.14**, a sleeve **15.11**, a number of washers built into one spacer **15.12** and a washer with a large exterior diameter **15.13**, illustrated in **Figs.** 3A, 14 to 18. In order to ensure the engagement of key with mating hole a protrusion „x_m" and circumferential clearance „c_c", explained in the next section, must be preserved by:

- correcting the length of spacer „l" by removing or adding washers and/or
- assembling a sleeve with exterior diameter „d", washer with exterior diameter „D" and/or spacer with diameter „d_R".

If desired, the sleeve **15.11** and spacer **15.12** can be made of soundproofing material.

Each hook **15.6**, shown in **Figs.** 4 and 4A, comprises a hook **15.20** with interior diameter „d_1" and gap „s_1", smaller than „d_1", a screw **15.21**, a number of washers built into one spacer **15.22**, a coil-spring washer **15.24** and a nut **15.25**. The symbols „s_1", „d_1" and „d_2" are shown in **Fig.** 4A. In order to ensure perfect engagement of the hooks with reinforcing rod **17.1d**, having diameter „d_2" smaller than „s_1", small tolerance zones, shown in **Fig.** 4A, must be preserved by:

- assembling a hook with gap „s_1";
- assembling a rod with diameter „d_2";
- correcting the distance „l_1" by removing or adding washers; and/or

– positioning the centres of the hook hole and the reinforcing rod out of alignment.

Fig. 15 exemplifies a new feature of numerous different planes, wherein the interengaging assemblies of any vehicular couple comprising e.g. the common or B-post section and the series-connected vehicle doors **8, 8B**, operate. When the doors are closed, key **33** protrudes the mating hole by „-x_m" (minus sign in respect to the opposite x-direction), which is limited due to the arc-travel path of the door about the axis of door hinges. The clearances of key **33** and the mating hole are denoted by „-y_m" and „y_p". The protrusion „x_m", circumferential clearance „c_c" (not drawn, represented by „-y_m" and „y_p" in y-direction) of the mating parts of each assembly and operating plane play a significant role on tight engagement thereof in accident. In the accident, above-mentioned in the problem case **E2** or **E3**, the door becomes detached due to large circumferential clearances of all mating parts of interengaging assemblies, which operate in the same z-y plane, and large inward deflection of the vehicle body **20** or side rail **18** in the opposite x-direction, during which under the load of inertia forces of the passenger the door is opened and moved in the arc-travel path about the axis of door hinges. Door detachment can be prevented by minimum tolerances, whereby the mating parts of interengaging assemblies of any vehicular couple, acting in the same operating plane, are governed.

In this time- and cost-saving feature against door detachment, proposed for the following embodiments, many interengaging assemblies of any vehicular couple comprising e.g. interengaging assemblies keys **32, 33, 34** & mating holes, must operate in numerous different planes, where the deformation of door **8** results in a tight engagement of keys **32, 34** with the mating holes, taken, the worse case is given, that all keys **33** fail to engage with the mating holes. The interengaging assemblies, comprising keys **32, 33, 34** & mating holes, operate in three different planes, the number of which can be increased by arranging these interengaging assemblies in the

planes, which, however, are offset to each other, e.g. in offset z-y planes. The interengaging assemblies keys **35** & holes act in the fourth operating z-y plane and keys **36** & holes in the fifth operating z-x plane. Owing to this feature the minimum tolerances of "narrow" are outdated, hence, replaced by permissible tolerances of "less narrow", "far less narrow", "small" and/or "medium", thus significantly lowering the reject rate, assembly time and costs. Advantageously, a pattern of the interengaging assemblies, governed by permissible tolerances, can be issued in a table handed to assembly workers. Alternately, this pattern can be coded in the assembly program to drill, position and assemble parts thereof within the permissible tolerances. The constant, small contour clearance and the proper tolerance between door lock **248** and striker **298**, above-mentioned in the problem cases **D** and **E**, can easily be accomplished at the assembly line within short time, thus making rework as well as adjustment work superfluous. It should always be reckoned with a reject when the assembly tolerances are, unexpectedly, larger than the permissible tolerances. Adjustment work for the interengaging assemblies of the rejected car can be done outside of the assembly line, thereby maintaining the production process and low reject rate. All these advantages outweigh the costs of extra material for a larger number of interengaging assemblies.

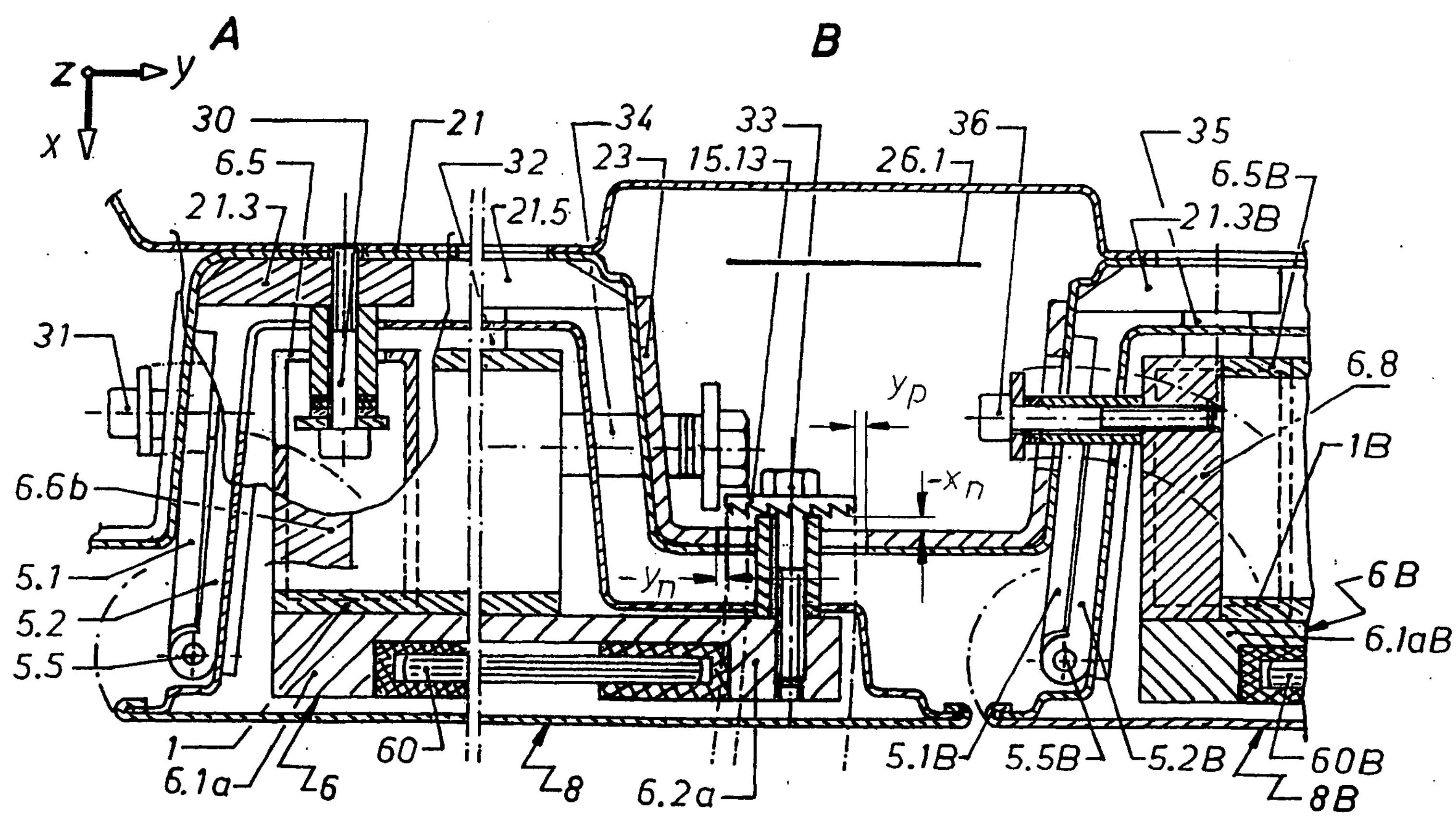
A washer **15.13** with radial teeth, serving as part of key **33**, clamps in the inner region of the reinforced B-post section in any collision or on rollover. As an integral part of a screw ref. to DIN 931 Form Z the washer won't come loose on assembly.

Costs can be cut by positioning an unadjusted key between adjustable keys, such as rivet **15.4a** ref. to DIN 660, fastened to the reinforcing plate of reinforcing panel **18.1a** arranged along the side rail. However, when the number of the interengaging assemblies is limited in a low-cost configuration, for perfect interengagement the provision with keys **15.1** to **15.8**, **30** to **37** without key **15.4a** is ultimately necessary.

Large total stress of the load cases **I to III** results in total deformation (buckling) of the post sections, side rail, vehicle roof and/or doors because stress of vehicle body and doors in an arbitrary real collision can never be predetermined in the research as well as in the three crash tests, above-mentioned in the problem case **E4**. To resolve such indeterminate stress the vehicular couples comprising front post section / door **8, 8B**, rear post section / door **8, 8B**, vehicle roof **17** / door **8, 8B** and side rail **18** / door **8, 8B** must be equipped with many interengaging assemblies operating in numerous different planes, such as keys **30** & holes acting in the first operating z-y plane, keys **31** & holes acting in the second operating z-x plane, key **15.2a** & hole, shown in **Fig.** 3, acting in the third operating z-y plane and in co-operation with additional interengaging assemblies, comprising keys **15.1, 15.2, 15.3, 15.3a, 15.4, 15.4a, 15.5, 15.5a, 15.6 to 15.8, 32 to 37** & receptacles, in the above-mentioned embodiments.

Although the present invention has been described and illustrated in detail, it is clearly understood that the terminology used is intended to describe rather than limit. Many more objects, embodiments, features and variations of the present invention are possible in light of the above-mentioned teachings. Therefore, within the spirit and scope of the appended claims, the present invention may be practised otherwise than as specifically described and illustrated.

Fig. 15



A
B
z
y
x
30
6.5
21.3
21
32
21.5
34
23
15.13
33
26.1
36
35
21.3B
6.5B
31
6.6b
5.1
5.2
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y_p
$-x_n$
$-y_n$
6.8
1B
6B
6.1aB
1
6.1a
6
60
8
6.2a
5.1B
5.5B
5.2B
60B
8B

[Click here and type return address and phone and fax numbers]

E17a-c

United States Patent and Trademark Office

E17a-c

Fax

To:	Giok Djien Go	**From:**	Examiner Jason Morrow
Fax:	49 6126 8949	**Pages:**	1, cover sheet only
Phone:		**Date:**	11/05/99
Re:	Draft for 08/860,182	**CC:**	

☑ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

• **Comments:** Go, please do not send your draft in by mail. This will only serve to clutter the case further. Please attempt to re-fax your specification. The fax machine yesterday ran out of toner and for this reason didn't accept all of your fax transmission. Contact me again before you attempt to re-fax.

E 22.6.97

* * * KOMMUNIKATIONSERGEBNISBERICHT (4.NOV.1999 23:15) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
689	SPEICHER SENDEN		MORROW USPTO	OK	S. 3/3

1-3

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

Dear Mr Morrow,

11/04/99

I amended the error "*minimum tolerances*" in Claim 3 pp. 18/col. 22 to "*permissible tolerances*" and added the symbol „$-x_n$", „$-y_n$" and „y_p" in Fig. 15 for the sake of better understanding the description. There is a BIG DIFFERENCE between the US-Description of the Preferred Embodiments and the non-US Description. Frankly to say, I was not able to understand the reason for narration till receiving your fax, wherein the explanation is found. I wish to thank you therefor and for the coming amendments/suggestions.

Please correct my work subdivided due to the limited RAM and faxed to you.
Should I later on mail you a complete copy *with* numeral references or *without*?
Thank you for your interest and help.

kind regards,

Go

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INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

* * * KOMMUNIKATIONSERGEBNISBERICHT (4.NOV.1999 23:17) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
690	SPEICHER SENDEN		MORROW USPTO	OK	S. 1/1

pp 4-6

FEHLERURSACHE

E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

E6 Clamping assemblies or adjustable interengaging assemblies to resolve problem case **E**.

Problem case **A**: In order to idealize an impact force $2F_1$, shown in **Fig. 10A**, imposed on a vehicle structure the following assumptions must be specified:

- let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.

Load case I in z-y plane in Fig. 5: The moment $M_x = H^*h$ about the x-axis is replaced by a pair of forces $H_A = (H^*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V^*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all post sections, series-connected doors 8, 8B reinforced by impact elements and

* * * KOMMUNIKATIONSERGEBNISBERICHT (4.NOV.1999 23:24) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
694	SPEICHER SENDEN		MORROW USPTO	OK	S. 3/3

pp 10-13

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
696	SPEICHER SENDEN		MORROW USPTO	OK	S. 3/3

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

transmitted through both head rests, integrated into the respective seatbacks, to the vehicle floor, thereby reducing the AIS of both passengers. AIS is an international acronym of Abbreviated Injury Severity ranging from 0 (no injury) to 6 (fatality).

Responsive to problem case **E**, adjustable and/or latching mechanisms are provided for interengaging assemblies, whose adjustable and/or latchable keys are bolted to the B- or C-post section, facing the termini of both reinforcing beams **1, 7** or **1B, 7B**, and whose mating receptacles are arranged thereto. Both plates **5.1, 5.2** of each hinge of vehicle door are provided with a rivet serving as key and an oblong mating hole. Owing to this feature load cases **I** to **IV** are resolved, but load case **V** and problem cases **E3 to E5** remain unresolved.

Evidently, due to load cases **I** to **V** and all problem cases **B, E, E1 to E5** "interengaging" assemblies of the remaining prior art are unsuitable for the purpose of energy-transmission and distribution by means of the integration of vehicle doors 8

* * * KOMMUNIKATIONSERGEBNISBERICHT (5.NOV.1999 19:12) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
705	SPEICHER SENDEN		MORROW USPTO	OK	S. 4/4

5 Nov

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

Dear Mr Morrow, 11/04/99

I amended the error "*minimum tolerances*" in Claim 3 pp. 18/col. 22 to "*permissible tolerances*" and added the symbol „-x_n", „-y_n" and „y_p" in Fig. 15 for the sake of better understanding the description. There is a BIG DIFFERENCE between the US-Description of the Preferred Embodiments and the non-US Description. Frankly to say, I was not able to understand the reason for narration till receiving your fax, wherein the explanation is found. I wish to thank you therefor and for the coming amendments/suggestions.

Please correct my work subdivided due to the limited RAM and faxed to you. Should I later on mail you a complete copy *with* numeral references or *without*? Thank you for your interest and help.

kind regards.

Go

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INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

Load case **IV** in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.

Load case **V** in z-x plane in **Fig.** 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column **22**, shown in **Fig.** 10A, 13, the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in load cases **IV** and **V**.

Problem case **B**: The majority of the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases **IV** and **V** be idealized to a lateral energy S_x, shown in **Fig.** 9, or

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
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for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

- to increase the vehicular stiffness

in the event of any collision and/or rollover. These interengaging assembly are arranged to the corresponding vehicular couples (vehicle member & mating vehicle member).

This principle and other objects of the present invention are accomplished by the following features (proposals):

- minimum tolerances by installing and adjusting the engaging keys from outside to tightly mate the receptacles thereby ensuring the connection of the doors with all vehicle members of vehicle body **20** such as post sections, vehicle roof **17**, flange **21**, a pair of side rails **18**, fastened to vehicle floor, in any collision and/or on rollover;
- interengaging assemblies with adjusting mechanisms such as holes & keys **15.1** to

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
712	SPEICHER SENDEN		MORROW USPTO	OK	S. 4/4

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

- intrusion of vehicle roof **17** into the vehicle body and of upper door frame **8.17**, thus squashing the passengers and
- buckling of the upper portion of the A-post section, total deformation of upper door frame **8.17**, buckling of vehicle roof **17** and buckling of side rails **18**, shown in **Fig. 8**.

In order to avoid the above-mentioned state a number of holes or keys **30** to **37** is arranged to the flange **21** *above*, *below* of the impact beams **1**, **7** and *therebetween*. When the *non-adjustable* rivets *5.6* of the door hinges in x-z operating plane are replaced by a number of interengaging assemblies **15.1**, **15.2a**, **15.4**, **30**, **31** in numerous operating planes, the total stress of the vehicular couples: A-post section & vehicle door along the z-axis is lower owing to stress distribution, thereby preventing, to a certain extent, the A-post section and vehicle door from total deformation and gap „o", shown in **Fig. 8**.

6.1, 6.2, 6.1B, 6.2B, shown in **Figs.** 1 and 3, are made from U-shaped thin panel. As *reinforcing elements* the window-guide elements are of higher-grade tensile strength **6.1a, 6.2a, 6.1aB, 6.2aB** to:

- reinforce the U-shaped window-guides of metal sheets,
- receive parts such as hooks, keys and/or holes and
- receive elements **6.5, 6.5B, 6.6a, 6, 6b, 6.7a, 6.7b, 6.8, 6.9** (not drawn) as structural element with higher-grade tensile strength.

The elements **6.8, 6.9** ref. to **Fig.** 14 are fixedly attached to the front faces of both impact beams **1B, 7B** and window-guide element **6B**, the elements **6.6b, 6.7b** to window-guide element **6** and impact beam **7** and the elements **6.6a, 6.7a** to window-guide element **6** and between both impact beams **1, 7**.

Both window-guide elements are replaceable by an U-shaped stiff window-guide element **6, 6B** shown in **Figs.** 2, 2A, 14 to 17. Less stiff elements **6.3, 6.3B** are

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
715	SPEICHER SENDEN		MORROW USPTO	OK	S. 4/4

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

costs as well as making tight engagement impossible resulting in door detachment in accident. To resolve these problems straight (non-curved, non-inclined or non-tapered) engaging surfaces are proposed for key and receptacle. The purpose of assembling and adjusting any key, shown in Figs. 3, 3A, 4 and 4A, from outside of the vehicle body **20** is to substantially cut labour time and costs. Costs can be enormously lowered by using mechanical connecting parts, particularly standard parts like washer (ref. to DIN 125), hexagon socket head screw (ref. to DIN 912) etc. With the exception of **15.4a** each key **15.1 to 15.5a, 15.7, 15.8, 30 to 37** comprises a screw **15.14**, a sleeve **15.11**, a number of washers built into one spacer **15.12** and a washer with a large exterior diameter **15.13**, illustrated in Figs. 3A, 14 to 18. In order to ensure the engagement of key with mating hole a protrusion „x_m" and circumferential clearance „c_e", explained in the next section, must be preserved by:

– correcting the length of spacer „l" by removing or adding washers and/or

* * * KOMMUNIKATIONSERGEBNISBERICHT (5.NOV.1999 19:47) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
716	SPEICHER SENDEN		MORROW USPTO	OK	S. 1/1

FEHLERURSACHE

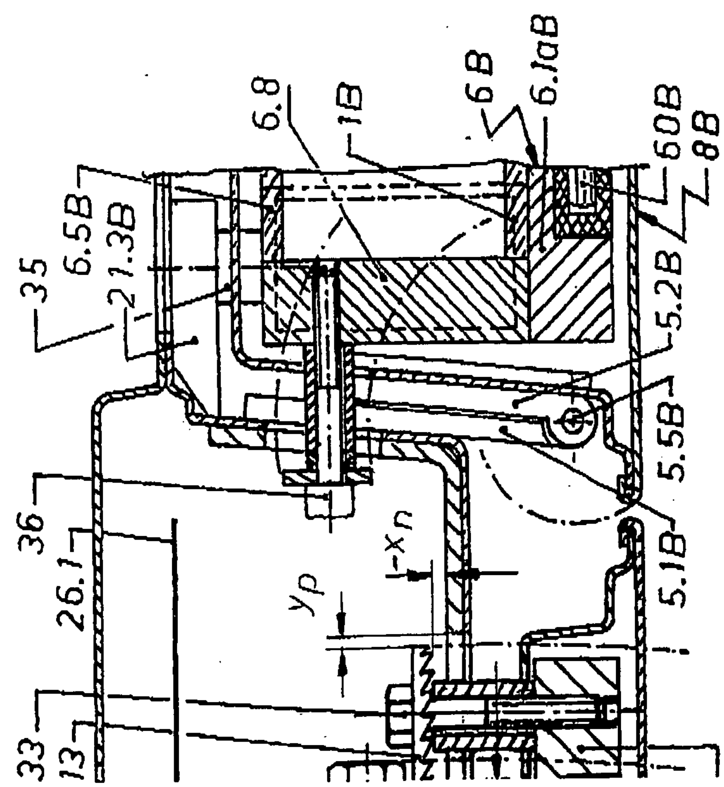
E-1) ÜBERTRAGUNGSFEHLER

E-2) BESETZT

E-3) KEINE ANTWORT

E-4) KEINE FAX-VERBINDUNG

B



* * * KOMMUNIKATIONSERGEBNISBERICHT (7.NOV.1999 22:03) * * *

TTI GO TECHNOLOGIES

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
717	SPEICHER SENDEN		MORROW USPTO	OK	S. 1/1

~~E18~~

19

Fax

E19

p.1b

FEHLERURSACHE

E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

Mr Jason Morrow
Group Art Unit 3612

Patent Appl. No. 08/860,182

Dear Mr Morrow,

11/07/99

Unfortunately, I discovered some errors.

Amendment of pp. 25/col. 6:

The Technical Mechanics Method

Amendment of pp. 29/col. 1 to 13:

Large total stress of the load cases e.g. **I to III** results in total deformation (buckling) of the post sections, side rail, vehicle roof and/or doors because stress of vehicle body and doors in a real accident can never be predetermined in the research and crash tests, three of which are mentioned in the problem case **E4**, due to the collision type, the boundary conditions and properties of two masses colliding against each other. Four front collision types are shown in **Fig.** 13. In a real accident a front, side and/or rear collision can end up in a pile-up or on a rollover, thus increasing the number of collision types and making a FEM calculation impossible. To resolve such indeterminate stress the vehicular couples comprising front post section / door **8, 8B**, rear post

Mr Jason Morrow
Group Art Unit 3612

Patent Appl. No. 08/860,182

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Please fax back your suggestion.

Thank you for your interest and help.

kind regards

Go

Office Action Summary

Application No.	Applicant(s)	
08/860,182	Go	
Examiner		Group Art Unit
Jason Morrow		3612

☒ Responsive to communication(s) filed on *Nov 10, 1999*.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-34* is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-34* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☒ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☒ All ☐Some* ☐None of the CERTIFIED copies of the priority documents have been

☒ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- *SEE OFFICE ACTION ON THE FOLLOWING PAGES* ---

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

2. Figures 1A, 1B, 2, 2A, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 18 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). The designations should NOT include the German equivalent label to "Prior Art".

Specification

3. The substitute specification filed 11/10/99 has not been entered because it does not conform to 37 CFR 1.125(b)because: the statement as to a lack of new matter under 37 CFR 1.125(b) is missing, a marked-up copy of the substitute specification has not been supplied (in addition to the clean copy). The marked up copy should include in brackets any material deleted from the specification and should include underlines under all new material added. The clean copy should be include all new material added and no material to be deleted.

A substitute specification filed under 37 CFR 1.125(a) must only contain subject matter from the original specification and any previously entered amendment under 37 CFR 1.121. If the substitute specification contains additional subject matter not of record, the substitute

specification must be filed under 37 CFR 1.125(b) and must be accompanied by: 1) a statement that the substitute specification contains no new matter; and 2) a marked-up copy showing the amendments to be made via the substitute specification relative to the specification at the time the substitute specification is filed.

4. A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required. The substitute specification filed must be accompanied by a statement that it contains no new matter.

5. The abstract of the disclosure is objected to because it is not narrative in nature and it refers to the speculative merits of the invention. Correction is required. See MPEP § 608.01(b).

6. Applicant is advised on how to arrange the content of the specification.

Content of Specification

(a) Title of the Invention: See 37 CFR 1.72(a). The title of the invention should be placed at the top of the first page of the specification. It should be brief but technically accurate and descriptive, preferably from two to seven words.

(b) Cross-References to Related Applications: See 37 CFR 1.78 and MPEP § 201.11.

© Statement Regarding Federally Sponsored Research and Development: See MPEP § 310.

(d) Reference to a "Microfiche Appendix": See 37CFR 1.96© and MPEP § 608.05. The total number of microfiche and the total number frames should be specified.

(e) Background of the Invention: The specification should set forth the Background of the Invention in two parts:

(1) Field of the Invention: A statement of the field of art to which the invention pertains. This statement may include a paraphrasing of the applicable U.S. patent classification definitions of the subject matter of the claimed invention. This item may also be titled "Technical Field."

(2) Description of the Related Art: A description of the related art known to the applicant and including, if applicable, references to specific related art and problems involved in the prior art which are solved by the applicant's invention. This item may also be titled "Background Art."

(f) Brief Summary of the Invention: A brief summary or general statement of the invention as set forth in 37 CFR 1.73. The summary is separate and distinct from the abstract and is directed toward the invention rather than the disclosure as a whole. The summary may point out the advantages of the invention or how it solves problems previously existent in the prior art (and preferably indicated in the Background of the Invention). In chemical cases it should point out in general terms the utility of the invention. If possible, the nature and gist of the invention or the inventive concept should be set forth. Objects of the invention should be treated briefly and only to the extent that they contribute to an understanding of the invention.

(g) Brief Description of the Several Views of the Drawing(s): A reference to and brief description of the drawing(s) as set forth in 37 CFR 1.74.

(h) Detailed Description of the Invention: A description of the preferred embodiment(s) of the invention as required in 37 CFR 1.71. The description should be as short and specific as is necessary to describe the invention adequately and accurately. This item may also be titled "Best Mode for Carrying Out the Invention." Where elements or groups of elements, compounds, and processes, which are conventional and generally widely known in the field of the invention described and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art, they should not be described in detail. However, where particularly complicated subject matter is involved or where the elements, compounds, or processes may not be commonly or widely known in the field, the specification should refer to another patent or readily available publication which adequately describes the subject matter.

(I) Claim or Claims: See 37 CFR 1.75 and MPEP § 608.01(m). The claim or claims must commence on separate sheet. (37 CFR 1.52(b)). Where a claim sets forth a

plurality of elements or steps, each element or step of the claim should be separated by a line indentation. There may be plural indentations to further segregate subcombinations or related steps.

(j) Abstract of the Disclosure: A brief narrative of the disclosure as a whole in a single paragraph of 250 words or less on a separate sheet following the claims.

(k) Drawings: See 37 CFR 1.81, 1.83-1.85, and MPEP § 608.02.

(l) Sequence Listing: See 37 CFR 1.821-1.825.

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of 37 CFR 1.71(a)-(c):

(a) The specification must include a written description of the invention or discovery and of the manner and process of making and using the same, and is required to be in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which the invention or discovery appertains, or with which it is most nearly connected, to make and use the same.

(b) The specification must set forth the precise invention for which a patent is solicited, in such manner as to distinguish it from other inventions and from what is old. It must describe completely a specific embodiment of the process, machine, manufacture, composition of matter or improvement invented, and must explain the mode of operation or principle whenever applicable. The best mode contemplated by the inventor of carrying out his invention must be set forth.

© In the case of an improvement, the specification must particularly point out the part or parts of the process, machine, manufacture, or composition of matter to which the improvement relates, and the description should be confined to the specific improvement and to such parts as necessarily cooperate with it or as may be necessary to a complete understanding or description of it.

The specification is objected to under 37 CFR 1.71 because it fails to provide an adequate description of the invention. The *Description of the Preferred Embodiments* should include more

than a simple listing of the parts present in each embodiment. This section should also point out the how the parts of the invention function during use. ***See the cited U.S. patents as examples of disclosures with correct form.***

8. If applicant continues to prosecute the application, revision of the specification and claims to present the application in proper form is required. While an application can be amended to make it clearly understandable, no subject matter can be added that was not disclosed in the application as originally filed.

Claim Objections

9. The claims are objected to because the lines are crowded too closely together, making reading and entry of amendments difficult. Substitute claims with lines one and one-half or double spaced on good quality paper are required. See 37 CFR 1.52(b).

Claim Rejections - 35 USC § 112

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claims 1-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The following terms or phrases are inferentially recited in the claims:

In claim 1:

-line 6, the "supporting door frame".

-line 14, the "compound assemblies".

In claim 2:

-lines 1 and 2, the " vehicle part of vehicle body".

-line 3, the "post sections".

In claim 3:

-line 2 of claim 3, the "vehicle part".

In claim 4:

-line 2, the "vehicle part".

In claim 6:

-line 3, the "interlocking holes".

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block".

-line 6, the "mutual post section".

In claim 7:

-line 3, the "interlocking holes".

-line 3, "both window-guide elements" and both "vehicle doors". Only one door and window guide element is positively recited.

-line 5, the "U-shaped block".

-line 7, the "side rail".

In claim 8:

-line 2, the "U-shaped block".

In claim 9:

-line 2, the "interlocking holes & interlocking blocks"

-line 3, the "post section".

-

In claim 10:

-lines 5 and 6, the "post section".

-line 6, the "reinforcing panel".

-line 7, the "side rail".

In claims 12 and 13:

-line 3, "interlocking holes".

-line 3, the "reinforcing panels".

-line 5, the "interlocking mating blocks".

In claim 14:

-line 3, the "interlocking blocks".

-line 3, the "reinforcing peripheral edges".

-line 5, the "interlocking mating holes".

In claim 15:

-line 3, the "interlocking block".

-line 4, the "top peripheral edge".

-line 5, the "interlocking mating holes".

In claim 16:

-line 4, the "bottom peripheral edge".

-line 3, the "interlocking block".

In claim 17:

-line 3, the "interlocking block".

-lines 3 and 4, the "post-section peripheral edge".

-line 5, the "interlocking mating hole".

-line 5, the "auxiliary part".

In claim 19:

- line 3, the “interlocking block”.

-line 4, the “post-section peripheral edge”.

-line 5, the “interlocking mating hole”.

-line 5, the “outer door-contour-shaped auxiliary part”.

In claim 20:

-line 5, the “post section”.

In claim 21:

-line 2, the “post section”.

-line 4, the “interlocking blocks”.

-lines 4 and 5, the “reinforcing element”.

-line 5, the “latch mechanism”.

-line 6, the “interlocking mating holes”.

-line 7, the “post section”.

In claim 22:

-line 3, the “interlocking block”.

-line 4, the “interlocking mating hole”.

-lines 4 and 5, the “reinforcing element”.

-line 5, the "striker".

-line 5, the "latch mechanism".

In claim 23:

-line 3, "the interlocking block".

-line 5, the "interlocking mating hole".

-line 5, the "post section".

-lines 5 and 6, the "reinforcing element".

-line 6, the "striker".

-line 6, the "latch mechanism".

In claim 24:

-line 2, the "U-shaped window-guide element".

In claim 25:

-line 2, the "U-shaped window-guide elements".

In claim 26:

-lines 2 and 3, the "window-guides".

In claim 27:

-lines 1 and 2, the "window guides".

In claim 28:

-line 4, the "interlocking hook".

-line 5, the "interlocking block".

In claim 29:

-line 2, the "washer".

In claim 30:

-line 2, the "screw".

In claim 31:

-line 2, the "screw".

In claim 32:

-line 1, the "sleeve".

In claim 33:

-line 5, the "supporting door frame".

-line 14, the "compound assembly".

In claim 34:

-lines 3 and 4, the "reinforcing element, transverse girder, reinforcing rod, plate, panel, and U-shaped block.

These terms must be positively recited.

In claim 1, the phrase "generally representing a tailgate, sliding side, cargo, liftgate door, trunk cover and vehicle door" is indefinite. The phrases seems to claim the vehicle door to represent all of the listed structures at the same time. It is suggested that the word "and" should be changed to --or--.

In claim 1 the phrase "arranged to that door frame" in lines 9 and 10 is indefinite for failing to particularly point out the relationship between the interlocking parts and the door frame.

In claim 1 line 10, the phrase "interlocking mating part to the vehicle body" is indefinite for failing to particularly point out the structural relationship between the interlocking mating part and the vehicle body.

In claim 1 line 12, the phrase "mechanisms to adjust to clearances of adjustable interlocking assemblies" is indefinite for failing to particularly point out what clearance between what parts is adjustable.

In claim 1, lines 13-17, the phrase "thus ensuring the engagement of all.............in the event of any real collision and/or rollover" is narrative in nature and fails to distinctly point out the structure of the invention.

In claim 2, lines 2 and 3, the phrase "reinforced by a reinforcing element and transverse girder" fails to distinctly claim the structural relationship between the vehicle part, reinforcing element, and the transverse girder.

In claims 3 and 4, line 2, the phrase "vehicle roof or siderail" is indefinite and fails to distinctly claim if the vehicle part is a roof or side rail. These vehicle parts are not interchangeable, and thus cannot be referred to in the alternative.

In claims 3 and 4, line 4 the phrase "disposed along that vehicle part" is indefinite and fails to distinctly claim the relationship between the reinforcing rod and the vehicle part.

In claim 5, line 4 the phrase "disposed along" is indefinite and fails to distinctly claim the relationship between the reinforcing rods and the vehicle roof and side rail.

In claims 6 and 7, lines 7 and 8, the phrase "transverse girder of the mutual post sections" fails to distinctly claim the structural relationship between the girder and the post section.

In claim 9 lines 3, the phrase "defined by disposing" does not distinctly claim the structural relationship between the structures in the claim.

In claim 10, lines 5 and 6, the phrase " reinforcing plate of the post section" indefinite and fails to distinctly claim the relationship between the reinforcing plate and the post section.

In claims 10 and 11 the phrase “disposed along the vehicle roof or side rail” is indefinite for failing to particularly point out the relationship between the reinforcing plate and the vehicle roof or side rail. It also is indefinite for failing to claim either the roof or side rail.

In claim 11, the use of the word “or” in line 7 renders the claim indefinite because it attempts to claim 2 different structures in one claim.

In claims 12, 13, 14, 15, and 21, the use of the word “disposed” renders the claim indefinite, as in the examples provided above.

In claim 16, line 5, the phrase “arranged in the auxiliary part” is indefinite and fails to distinctly claim the relationship between the interlocking mating hole and the auxiliary part.

In claim 18 lines 2 and 3, the phrase “adapted to the outer door-contour” and the phrase arranged to the window-guide” are indefinite and fail to distinctly claim the relationship between the auxiliary part and the window-guide element and impact beams.

In claims 20, 22, and 23 the phrase “arranged in the post section” is indefinite and fails to distinctly claim the relationship between the post section and the interlocking mating hole.

In claim 28, the phrase “with interior diameter d1 and gap s1" is indefinite since the shape of the interlocking hook is not positively recited.

In claim 32, the phrase “interlocking part with exterior diameter d” is indefinite since the shape of the interlocking part is not positively recited.

In claim 33, the phrase "generally representing a tailgate, sliding side, cargo, liftgate, and vehicle door" is indefinite. The phrase seems to claim the vehicle door to represent all of the listed structures at the same time. It is suggested that the word "and" should be changed to --or--

.

In claim 33 the phrase "arranged to that door frame" in line 10 is indefinite for failing to particularly point out the relationship between the interlocking parts and the door frame.

In claim 33 line 11, the phrase "interlocking mating part to the vehicle body" is indefinite for failing to particularly point out the structural relationship between the interlocking mating part and the vehicle body.

In claim 33 line 12, the phrase "mechanisms to adjust to clearances of adjustable interlocking assemblies" is indefinite for failing to particularly point out what clearance between what parts is adjustable.

In claim 33, lines 14-21, the phrase "wherein the interlocking ....in the event of any real collision and/or rollover" is narrative in nature and fails to distinctly point out the structure of the invention.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

13. Claims 1, 2, 26-28, 31-34 are rejected, as best understood, under 35 U.S.C. 102(b) as being anticipated by Pavlik.

Re claims 1, 33, and 34, Pavilk discloses an increased stiffness of vehicle structure comprising a main vehicle body having at least one door aperture, a mating vehicle door, a supporting door frame having at least two impact beams (25, 27), auxiliary parts and at least one window guide element, the door being hingedly secured to the vehicle body for pivotal movement between an open and a closed position, interlocking assemblies (28, 48) each of which include an interlocking part attached to the door frame and interlocking mating part attached to the vehicle body, and adjusting mechanisms to adjust clearances of the adjustable interlocking assemblies.

Re claim 2, the vehicle part of the vehicle body receiving the interlocking parts is reinforced by a reinforcing element and a transverse girder (the roof) of the post sections of both vehicle sides.

Re claim 26, the window guides are rigidly attached to the respective stiff window-guide elements.

Re claim 27, the two window-guides are rigidly attached to the stiff window-guide element.

Re claim 28, the interlocking part comprises a mechanical connection element, and interlocking hook, a sleeve, a washer, and means to adjust the clearances between the mating interlocking parts (figure 5).

Re claim 31, the washer is an integral part of a screw.

Re claim 32, the exterior diameter of the washer is greater that the diameter of the spacer.

Allowable Subject Matter

14. Claims 3-25 and 28-32 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

15. ***An examination of this application reveals that applicant is unfamiliar with patent prosecuting procedure. While an inventor may prosecute the application, lack of skill in this field usually acts as a liability in affording the maximum protection for the invention disclosed. Applicant is advised to secure the services of a registered patent attorney or agent to prosecute the application, since the value of a patent is largely dependent upon skillful preparation and prosecution. The Office cannot aid in selecting an attorney or agent.***

Applicant is advised of the availability of the publication "Attorneys and Agents Registered to Practice Before the U.S. Patent and Trademark Office." This publication is for

sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Morrow whose telephone number is (703) 305-7803. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 5:00 PM.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1113.

The fax phone number for the organization where this application or proceeding is assigned is (703) 305-7687.

jsm

April 6, 2000

JASON MORROW
PATENT EXAMINER

D. GLENN DAYOAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

Door for a passenger car or truck

Description

The present invention relates generally to vehicle doors, more particularly, to window-guide elements in co-operation with interlocking assemblies of the vehicle members (see definition) in order to properly engage all series-connected doors with the vehicle roof and side rail (sill portion) arranged along the vehicle floor, all post sections (pillar portions) and the transition regions of passenger compartment in the event of arbitrary collision (front, side or lateral, rear collision and/or rollover (overturn), thereby protecting the passengers against ejection from the passenger compartment and substantially enhancing the survival chance and vehicular stiffness.

The opposed prior art documents are below-mentioned, such as DE-OS 4342038 A1, DE-OS 2162071, DE 3103580 A1, US 3819228, EP 0423465 A, EP 0642940 A, EP 0659601 A and DE 3726292 C1 ref. to the German examination report of DE 19530219 of 09.09.96 and PCT search report of 24.03.97.

It is known in the prior art to provide interlocking (interengaging) assemblies to engage and to clamp the vehicle doors with the other vehicle members, thus enhancing the stiffness of vehicle side under load of the side impact force. However, all these conventional configurations do not take into account the failure of passenger protection due to disengagement (release) of the interlocking assemblies in the event of arbitrary collision [1 to 5]. Most of the vehicles involved in the accident in these examples are German cars with the world-wide reputation offering for the best survival chance, which have always achieved good to best verdicts in the front crash tests. Volvo enjoys this reputation too. Disengagement of interlocking assemblies in the event of front, side or rear collision has always ended up, very deplorably, in fatal injuries of passengers after

- being ejected from a German vehicle [1, 3] in **Fig.** 1 during the rollover,
- the ejection of all four passengers from a German luxurious car [1, 2] during the rollover, whereamong one was instantly dead, after the front collision against a tree on a **street** of Wiesbaden-city,
- the detachment of tailgate-door **8T** resulting in the ejection of a boy from a minivan whose American car-manufacturer was fined $ 262.5 millions by the jury in South Carolina [1, 5],
- being subjected to the intrusion of deformed driver-door of another German luxurious car [1]. Despite the use of crowbar and welding burner to forcefully open the driver door, which was overstressed, hence, *clamped* with the passenger compartment (cell), for the purpose of first aid, all help for the driver was too late.

The following problem cases

I. large tolerances due to manufacturing and assembly,
II. analogy,
III. load cases according to Technical Mechanics in real front and side collision and
IV. wrong assumption idealized (specified) for a single load case of the prior art

substantiate the release of **free connection** of interlocking assemblies of door locks and impact elements, as noted hereinafter:

Problem case **I:** Recently in automotive industry, great efforts have been made to achieve (finish) an uniform (constant), small contour clearance between the outer door-contour "abcde" of vehicle door **8, 8B** and the door aperture **20.1, 20.1B, 20.1T, 20.1x** of passenger compartment in **Fig.** 1, 17, 18 in order to minimize flow noise and, particularly, to yield an attractive design. Sales success is determined by the overall impression of design. In the state of assembly the contour clearance e.g. of AUDI ® vehicles is 2.5 mm and VW Passat ® vehicles 3.5 mm [8].

For the purpose of automatic assembly under the above-mentioned goal, a device ref. to DE 3726292 C1 determining six reference points on the outer door-contour calculates the differences between the outer door-contour and the door aperture of passenger compartment in **Fig.** 18 by assembly, disassembly and assembly of the same vehicle door. Due to the small distances of overlaying coils denoted as $w \leq 0.2$ mm in **Fig.** 11, noises such as rattle etc. [7] occur at different oscillations when driving. This condition is comparable with the distances of engaging members to each other.

Among the prior art the U.S. Pat. No 4,307,911 (DE 3103580 A1), improving the U.S. Pat. No 3,819,228, shown in **Fig.** 10A, is chosen to outline the disengaging problem of

- the engaging bolts **148, 128a to 128c**, rigidly attached to the assembled vehicle door, which is supplied to the assembly line, and
- the mating receptacles **198, 158a to 158c**, rigidly attached to the passenger compartment, which is assembled at assembly line.

In order to avoid expensive reworking at the assembly line, high reject quote and customer complaints due to disturbing noises [7] it is necessary to provide the design with large tolerances, substantially larger than the assembly- and locking tolerances between the stud **298** and catch of door lock **248**. Therefore, the adjusting device ref. to DE 4342038 A1 and new invention is necessary to reduce tolerances to minimum from outside.

Problem case **II:** As exemplified in **Figs.** 11, 12, [6, 7], both end coils of compression-coil spring **19** are innerly guided by two spring seats **19.1**. Their utmost outer nodes KN_1 and KN_{End} (not drawn) rest against both stops **19.3**, where i represents the number of coils. Such guide embodiment corresponds to form-locking connection. To survey the rolling behaviour of end coil **19** on the lower spring seat **19.1** the end coil is idealized in elements by supporting springs in reference to the nodes and by the threshold value of the distance in the "state of rolling" $s < 0.1$ mm. **Fig.** 12, [1 and 2] illustrate the rolling behaviour in regard to the FEM data and test data marked with M in dependence on F_z = -790, -1000 and 3000 N:

- According to test data KN_2 to KN_5 roll on the spring seat at F_z = -790 N, but in the state of disengagement at F_z = -1000 and -3000 N.
- According to FEM data the nodes in the following states are in dependence on F_z:

F_z	State of contact	State of rolling
-108	KN_1, KN_{15}, KN_{17}	KN_1 - KN_3, KN_{10} - KN_{18}
-250	KN_1, KN_{19}, KN_{20}	KN_1, KN_{15} - KN_{23}
-1415	KN_1, KN_{17}, KN_{19}, KN_{20}, KN_{30}, KN_{31}, KN_{33}, KN_{34}	KN_1, KN_{15} - KN_{35}

Some of the interlocking assemblies in free connection are disengaged from each other on increase of impact energy. This is comparable with the disconnection of some elements of both end coils from the spring seats due to resilient property while the end coils roll thereon.

Problem case **III:** In order to idealize a vehicle in the undermentioned load cases the following assumptions must be specified:

- let the front impact force 2F along the centre line of the car replace the uniform loading due to the impact energy.
- let the structure of vehicle be replaced by two symmetric vehicle sides.

Load case I in z-y plane in **Fig.** 5: The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. These forces exert bending moment along the y-axis imposed on the vehicle side comprising all post sections, series-connected doors **8, 8B** with impact elements and interlocking assemblies of those doors and post sections

Load case II in z-x plane in **Fig.** 6: The force V exerts bending moment M_{zx} along the x-axis and rotating moment $M_y = V*b$ about the y-axis acts as torsional moment along the vehicle side.

Load case III in x-y plane in **Fig.** 7: The A-post section is under load of rotating moment $M_{xy} = -H*b$. The vehicle side is subjected to bending moment M_{xy} along the y-axis and buckling force H.

Subjected to the total stress of bending moments M_{zx}, M_{xy}, M_{zy}, buckling force H and torsional moments M_z, M_y in the **load cases I to III** the vehicle side in **Fig.** 8 is deformed in real front collision [1, 2].

By reversibly positioning the series-connected doors **8, 8B** the same load cases are valid for real rear collision.

Load case IV in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.

Load case V in z-x plane in **Fig.** 10: Under load of side impact energy S at impact angle γ or in the real side collision against a highway column or tree the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in **load cases IV and V**.

Problem case **IV:** Among the four collision types, shown in **Fig.** 13 [9] the collision type U2 shows the **highest** percentage of severe and fatal injuries in side collision at the range of impact angle $0° < \alpha < 90°$ against the driver door, as illustrated in **Fig.** 9.

Problem case. **V:** With the exception of DE 4342038 A1, the release of free connection of interlocking assemblies of prior art is attributed to the following assumption for the **ideal load case**:

- let the *centre* of vehicle door be subjected to side impact energy S with impact angles $\gamma = 0°$ *and* $\alpha = 0°$ in **Figs.** 1, 1A, 1B, 10A and
- let *free* connection be valid for form-locking connection.

The illusory assumption and reduction of the load cases **I** to **V** to simple loads account for the failure of passenger protection of the following vehicles in crash tests and real accident in **Fig.** 10A:

- In a crash test [12] corresponding to collision type U1 in **Fig.** 13 the collision of the very high bumper of a sport-utility vehicle (jeep) against the vehicle side of a test vehicle results in gaps between each vehicle door, totally deformed, and the respective door aperture **20.1, 20.1B** of passenger compartment **20** and in collapse of the B-post section.

- According to EP 0642940 A1 (US. Pat. Nr. 5518290, DE 4330620) a catching hook **148**, fastened to the reinforcing element of vehicle door, should clamp into the a site **198** of predetermined fracture, located on the B-post section, if that reinforcing element is deformed in side collision. Contrarily, one of the reinforced doors became detached from the passenger compartment of luxury car [1, 2] of the patent proprietor in the front collision to a tree, whereafter the detachment of all doors occurred in rollover.
- When the side rail of a two-seater new expensive model [1, 3] in **Fig.** 1 collided against a column **22** of the central barrier in **Fig.** 13, the impact energy totally deformed the doors **8, 8T**, which became detached, thus allowing the ejection of all four passengers from the passenger compartment during the rollover of the vehicle.
- According to EP 0423465A1 of proprietor, a German sport-car manufacturer building a classic, very expensive sport car [4], a stiff hook of reinforcing ledge **25.2,** rigidly mounted to lower door frame **8.18,** should engage with the thin mating panels of a reinforcing plate **25.1,** rigidly attached along sill rail **18** in **Fig.** 1, 8, serving as sites of predetermined fracture. However, the compound assembly vehicle roof **17** & upper door frame **8.17** are subjected to lateral load F_o. The lack of interlocking assemblies became obvious in the rollover of this classic sport car [4], which plunged seven meter downwards and crashed with vehicle roof **17** at a lower level of an underpass in Wiesbaden City thus totally deforming vehicle roof **17**, body **20** and both upper door frames **8.17** during rollover, where the remaining energy was transmitted through both head rests, integrated into the respective vehicle seats, to the vehicle floor.

Evidence for failure of the prior art, resulting in door detachment associated with passenger ejection and intrusion of vehicle members and/or power plant (drive assembly) associated with severe/fatal injuries, is listed in the 53-page report [1], submitted to the EU-; US-, German and Canadian Administration, for the purpose of minimizing injury-severity level, number of injuries and injury-related costs, over $ 1 billion per day, in real accidents of vehicles world-wide, some of which, having always achieved very good to best verdicts in the front crash tests, are German and Volvo cars known world-wide as the safest. A director of NHSTA [13] has confirmed the correctness of the theses and commitment therefor.

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*all series-connected doors*"	one or arbitrary (generally) series-connected doors of each vehicle side
"*girder*"	panel, shell, beam etc. according to FEM and Technical Mechanics
"*window-guide elements*" of vehicle doors	window-guides **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body

"*mating parts of interlocking assembly*	engaging mating members of an interlocking assembly such as key & receptacle, engaging hook & engaging recess, engaging hole & engaging key or engaging hook & engaging rod
"*engaging hole*"	engaging aperture, engaging slot, engaging oblong hole
"*compound assembly*"	two vehicle mating members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & peripheral edge (transition region), vehicle door & post section/s, vehicle door & vehicle door, vehicle door & vehicle body in engagement in the event of any collision and/or rollover

As exemplified by US Pat. Nr. 3819228, the overall stylish impression spoilt by a *bulky engaging bolt projecting through the inner panel and passenger compartment*, will, doubtless, not be beneficial to sales. When stepping in or out of the passenger compartment while cleaning or repairing, the passenger can injury himself upon stumbling over this *bulky* engaging bolt.
When closing the door, the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent.
See problem case **V** and countermeasures in Chap. G, H and J.

In side collision in **Figs.** 1, 1A the interlocking assemblies ref. to DE-OS 2162071 comprising contour tongues **16.1** and contour grooves **16.2** should be in form-locking connection in order to clamp the vehicle door with side rail **18,** vehicle roof **17** in **Fig.** 1A and B-post section. Without interlocking assembly at the B-post section, closing or opening of the door would be possible if the outer door-contour "abcde" were square. Regarding the recent contour design in **Figs.** 5 and 18 the line "ab" is curve-shaped, line "bc" of front door inclined ($\beta > 90^0$) or spatially curve-shaped and line "bc" of rear door spatially S-shaped. Such contour design makes it impossible to close the door because the contour grooves **16.2** cant against the contour tongues.
In order to sustain large impact energy the contour groove must be reinforced by an element which, unfortunately, cannot be attached to the narrow upper window frame.
See problem case **V** and countermeasures in Chap. H and J.

Ref. to EP 0659601 A1 (US. Pat. No. 5297841) an arbitrary L-shaped reinforcing element with an engaging hook and engaging aperture is vertically fastened to the side panel of the first cargo door. In side collision the hook engages with the hole of the side rail and the stud of the second cargo door with the aperture of the first cargo door, similar to EP 0423465 A1 in **Fig.** 1B. Contrary to EP 0423465 A1, DE 4342038 A1 and the feature of window-guide elements with engaging members:

- the *vertically* reinforcing element does not increase the bending stiffness of the vehicle in longitudinal direction,
- the hook as Achilles' heel and the other interlocking assemblies *cannot* withstand the lateral load in side collision.

Ref. to DE 4342038 A1 the members of interlocking assembles *2.1* are arranged to both impact beams **1, 7,** or **1B, 7B** and the respective post section and members of interlocking assemblies *5.6* to the frames **5.1, 5.2** of both hinges in **Fig.** 15. In arbitrary collision (front-, rear-, side collision and/or rollover) all vehicle doors are always in engagement with all post sections owing to the state of interlocking the members of interlocking assemblies adjustable from outside and/or blocking via locking pieces and/or interlocking thereof via permissible tolerances, thus increasing the stiffness of vehicle as well as lowering the stress. See shortcomings in Chap. I.

The tests for passenger protection are permanently becoming stricter and more comprehensive by FMVSS 214, EU-side crash test and the EU front crash test. In the 1st step of the EU front crash test the vehicle is crashed at 50 km/h against a 100% offset-barrier with an impact area having a 30° inclination and two vertical bars for anti-gliding thereof and in the 2nd step valid from the beginning of Oct. 98 the vehicle is crashed at 55 km/h against a deformable 40% offset-barrier.
Ref. to ADAC 9/1995 different states of deformation are reproduced in three crash tests of the involving vehicles of the same type crashed against

- a very stiff barrier,
- a deformable barrier and
- another vehicle of the same type

because the uniform load, deformable property of two colliding masses, impact condition etc. are different.

In the both replies [10] to the inquiries and requirement to adjust the interlocking assemblies to permissible tolerances ref. to DE 4342038 A1 the Institute of Vehicle Safety (German NHSTA) has confirmed the ejection of the passengers from the passenger compartment due to the deficiencies of the conventional interlocking assemblies of the doors and the necessities to improve the boundary condition on the interlocking assemblies and door in order to preserve the door interlock and to distribute the impact energy.

Accordingly, the principle object of the present invention is to overcome the deficiencies of the prior art by providing form-locking connection for interlocking assemblies having large tolerances, which are necessary in car manufacturing and door assembly, in order

- to protect passengers against ejection from the passenger compartment and/or intrusion of vehicle member and
- to increase the vehicular stiffness

in the event of arbitrary collision. These interlocking assemblies are arranged to the corresponding compound assemblies (vehicle members & mating vehicle members).
This principle and other objects of the present invention are accomplished by the following features (proposals):

- form-locking connection by installing and adjusting engaging members from outside to permissible tolerances (clearances) to guarantee the state of interlocking of interlocking assemblies thereby ensuring the connection of the series-connected doors with all post sections, vehicle roof 17, vehicle frame fastened to two side rails **18** facing each other and passenger compartment **20** in arbitrary collision;
- interlocking assemblies with adjusting device such as engaging holes & engaging keys **15.1 to 15.5a, 15.7, 15.8,** engaging hooks **15.6** & reinforcing rod **17.1d** and engaging holes & engaging keys **30 to 37** in **Fig.** 1, 3, 3A, 4, 4A and 14 to 18;
- window-guide elements to accommodate the engaging members;
- space-saving, inexpensive design for engaging members;

- arrangement of engaging members in at least two operating planes of a compound assembly;
- arrangement of engaging hole in a vehicle member for the purpose of force-locking accommodation of engaging key therein and
- U-shaped housing to force-locking connect the engaging members with the engaging mating members of vehicle doors in juxtaposition.

Despite the failure of the prior art in the event of real arbitrary side collision any modification and extra design for survival chance in real arbitrary collision will generate costs, R&D expenses and weight due to the use of other inventions.
Summary of the advantages of the present invention:

A) saving labour-time by installing and adjusting engaging members from outside the passenger compartment.
B) low reject rate.
C) space-saving, inexpensive design.
D) dissimilar operating planes for each compound assembly to optimize the interengagement of its interlocking assemblies in association with energy absorption due to load cases in different planes. **Figs.** 14 to 18 illustrate *a single compound assembly*: window-guide element & B-post section with the interlocking assemblies: engaging keys **34** & engaging holes in z-x plane acting as the first operating plane, however, interlocking assemblies: engaging keys **32, 33** & engaging holes in z-y plane acting as the second operating plane. The permissible tolerances may be specified from "narrow" to "less narrow", thus cutting costs for the adjustment work. This feature of dissimilar operating planes is applicable too for both interlocking assemblies: engaging holes & **15.1, 15.2a** and **15.2, 15.3** and **15.4a, 15.5** etc. in **Fig.** 3. A row of the same engaging keys is operative in dissimilar operating planes by arranging a number of the same engaging keys **15.1** to the spatially inclined A-post section or of blocks **33** to the spatially inclined B-post section. In reference to the global xyz coordinate system the engaging key **15.2a** & engaging hole is operative in an inclined plane.
   Because the hinge bolts of the front and rear doors have an operating direction in z-axis the arrangement of interlocking assemblies: engaging holes & blocks **31, 36** to one operating plane is sufficient. However, any additional arrangement of engaging holes & blocks **30, 35** improves the door interlock and substantially decreases fatal injuries in any real collision.
E) minimizing the R&D work by reducing FEM calculations, crash tests and by saving material due to the arrangement of interlocking assemblies in different operating planes.
F) passenger protection for all collisions by a **single** construction, manufacturing, testing expenditure, assembly and material supply.
G) exploitation of the transition regions **21, 21T, 21h, 21x** of passenger compartment **20** provided with isolation material **21.10** in **Figs.** 17, 18 due to the sites to accommodate engaging members and the continuous stress curve. The enlargement of the transition regions to a limited extent neither impairs the overall stylish impression nor obstructs the passenger from ingress to or engress from the passenger compartment. Those regions of all post sections are defined by the dotted lines "a1", "b1", "b2" and "c1".
H) overall stylish impression. As substitutes of the bulky engaging bolt ref. to US Pat. Nr 3819228 small engaging members are inconspicuous, therefore making it possible to spread them out along the window-guide elements, thus lowering the stress. Due to this feature it is possible to arrange the engaging members

- **30, 32, 35, 37** to the respective transition regions **21** of passenger compartment **20.** Contrary to US Pat. Nr. 3819228 this feature won't endanger passenger when stepping in or out, furthermore, useful for passenger protection in side collision, particularly, according to collision types U1 and U2 in **Fig.** 13 as well as in front collision.
- **15.2a, 15.2, 15.7** e.g. with screws M4 to the narrow window-guide element **6.3, 6.3B** of upper door frame **8.15** to resolve the problem of the large, stiff contour groove ref. to DE-OS 2162071.
- **33, 34, 36** to the respective window-guide elements **6, 6B** and auxiliary parts **6.7, 6.8** in engagement with the reinforced B-post section without obstructing the operation of the seat belt **26.1** in **Fig.** 15. The fact, that no contact is made during the opening operation of series-connected vehicle doors, is demonstrated by the trajectories of both outer points of the washer and of the door edges drawn with dotted lines.
- **31** to the respective window-guide elements **6** and auxiliary parts **6.6a** in engagement with the reinforced A-post section.

I) less stress to solve the problem of total deformation. By means of arrangement of interlocking assemblies in multi-operating planes and increase of compound assemblies such as vehicle door & vehicle roof **17**, vehicle door & side rail **18**, vehicle door & post section(s) and vehicle door & passenger compartment **20** more vehicle members in compound construction are involved in energy absorption in different load cases in the event of arbitrary collision.
In conjunction with DE 4342038 A1 the structural stiffness reaches the maximum. Beyond doubt, the advantage of members of interlocking assemblies *2.1, 5.6* & engaging holes is due to the further exploitation of the very stiff impact beams **1, 7** to house the engaging members. Because the other compound assemblies such as vehicle door & side rail and vehicle door & vehicle roof are not equipped with interlocking assemblies this *single* arrangement of one compound assembly in mid region is insufficient in the event of real arbitrary collision, therefore endangering the passengers in the following state of deformation
- intrusion of vehicle roof into the passenger compartment and of the upper and lower door frame **8.17** and **8.18**, thus squashing the passengers and
- buckling of the upper portion of the A-post section, total deformation of the upper door frame, buckling of vehicle roof **17** and buckling of side rails **18** in **Fig. 8.**

In order to avoid the above-mentioned state a number of engaging holes & engaging keys **30 to 37** is arranged in the regions *above, below* of the impact beams **1, 7** and *therebetween* by eliminating those interlocking assemblies *2.1, 5.6.*
When the *non-adjustable* engaging members *5.6* of the door hinges in x-z operating plane are replaced by a number of interlocking assemblies **15.1, 15.2a, 15.4, 30, 31** in several operating planes, the total stress of the compound assemblies: A-post section & vehicle door along the z-axis is uniform and lower due to stress distribution, thereby preventing to a certain extent the A-post section and vehicle door from total deformation in **Fig.** 8.

J) protection the passengers against ejection from the vehicle involved in the accident and against total deformation of the vehicle ref. to problem case **V**, where the doors are less deformed. This failure is solely resolved by interlocking of the following interlocking assemblies governed by the permissible tolerances:

- engaging holes & engaging keys **15.3, 15.3a, 15.5a, 15.5** thanks to the U-shaped housings **17.3, 18.3**, whose deformation causes a constrained deformation of the juxtaposed vehicle doors, vehicle roof and side rails,
- engaging holes & engaging keys **32, 33, 34, 30, 15.4, 15.4a** thanks to force-locking accommodation of the engaging keys in the engaging holes and arrangement of the pairs in dissimilar operating planes (Chap. D); *and/or*
- engaging hooks **15.6** & reinforcing rod **17.1d** for both compound assemblies such as juxtaposed vehicle doors & side rail and juxtaposed vehicle doors & vehicle roof, so that the deformation of the side rail and vehicle roof causes a constrained deformation of the juxtaposed vehicle doors; and

by *force transmission* into the other vehicle side by means of transverse girders **17.2, 17.2b, 17.2c, 17.2d, 18.2** of vehicle roof and side rails, thus force-locking connecting all post sections facing each other. Fatal injuries and total deformation in any real collision are minimized by the energy distribution and the increase of energy absorption.

K) passenger protection by door interlock in rear collision. Detachment of rear door and driver door in rear collision occurs due to the lack of door hinges and interlocking of engaging members of doors and post sections. For the purpose of door interlock the properties of force transmission and of interlocking of engaging members are improved by the connection of rear door **8B** with the C-post section in association with the attachment of

- auxiliary part **6.5C**, adapted to the outer door-contour to the parts of rear door, having engaging holes to engage with engaging keys **37** in **Figs.** 14, 18 and
- engaging keys **33, 34** to window-guide element **6B**.

The features of vehicle door are, doubtless, suitable for tailgate door **8T**, sliding side door, liftgate door cargo door, trunk cover **8x** in **Fig.** 18, hood **8h** in **Fig.** 1, series-connected doors, e.g. three vehicle doors with four post sections of large van.

The invention will be described, by way of example only, with the reference to the accompanying drawings, in which:

Fig. 1 is a side view of vehicle side, impact beams, engaging keys, engaging hooks, window guides and window-guide elements (reinforcing elements).

Fig. 1A is a cross-sectional view of a vehicle door engaging with a roof and side rail ref. to DE-OS 2162071 in side collision.

Fig. 1B is a cross-sectional view of a vehicle door engaging with a side rail ref. to EP 0423465 A1 in side collision.

Fig. 2 is a side view of an U-shaped window-guide element, the position of engaging keys **15.7, 15.8** and of an additional window-guide element **6.4, 6.4B**.

Fig. 2A is a side view of an U-shaped window-guide element, the position of engaging keys **15.7**.

Fig. 3 is a perspective view of a front door frame with both window guides, both respective window-guide elements and interlocking assemblies of the 1st embodiment.

Fig. 3A is a cross-sectional view of an engaging key with adjusting device.

Fig. 4 is a perspective view of interlocking assemblies engaging hooks & reinforcing rod of the 2nd embodiment.

Fig. 4A is a cross-sectional view of the engaging hook with adjusting device and of the reinforcing rod.

Fig. 5 illustrates a load case I in z-y plane in front collision of vehicle.

Fig. 6 illustrates a load case II in z-x plane in front collision.

Fig. 7 illustrates a load case III in x-y plane in front collision.
Fig. 8 is a state of total deformation of vehicle at displacement v in front collision.
Fig. 9 illustrates a load case IV in x-y plane in side collision of vehicle.
Fig. 10 illustrates a load case V in z-x plane in side collision.
Fig. 10A illustrates the mating parts of interlocking assemblies ref. to U.S. Pat. No 4,307,911 (DE 3103580 A1), both mating parts of a door lock, the general force F_1 or S_1 in the event of front or side collision and a highway column.
Fig. 11 is a view of a compression-coil spring on a lower spring seat.
Fig. 12 illustrates the projection of the end coil and spring seat in a plane, the test data and FEM data of an end coil rolling on the lower spring seat in dependence on load.
Fig. 13 illustrates four collision types U1 to U4 ref. to the research work of Technical Vehicle Office.
Fig. 14 is a perspective view of interlocking assemblies of the 3rd embodiment comprising a front door frame having a single window-guide element and a rear door frame having a single window-guide element to engage with the post sections.
Fig. 15 is a cross-sectional view of the series-connected doors in engagement with the A-, B-post section and of the passenger compartment along the line D-D in **Fig.** 14.
Fig. 16 is a side view of the series-connected door frames without window pane in engagement with the B-post section according to arrow E in **Fig.** 14.
Fig. 17 is a perspective view of interlocking assemblies of the 4th embodiment comprising a front door frame having a single window-guide element in engagement with the transition regions of passenger compartment.
Fig. 18 is a side view of the transition regions of passenger compartment.

In **Fig.** 3 the 1st embodiment consists of interlocking assemblies, whose engaging members are attached to two window-guide elements of vehicle door and whose engaging mating members to the A- and B-post section, vehicle roof and side rail.

In **Fig.** 4 the 2nd embodiment consists of an interlocking assemblies, whose engaging hooks are attached to two window-guide elements of each vehicle door and whose reinforcing rod to the vehicle roof and all post sections. The reinforcing rod serves to reinforce the vehicle roof and to aid positioning at the assembly thus cutting costs. However, this embodiment needs space, which is available in large cars, trucks and vans.

In **Figs.** 14 to 16 the 3rd embodiment consists of interlocking assemblies, whose engaging members are attached to a window-guide element of each vehicle door **8, 8B** and whose engaging mating members to the A-, B-post section and respective reinforcing elements **21.3, 21.3B** of transition regions **21** of passenger compartment **20.** The engaging keys **30 to 37 &** engaging holes can arbitrarily be attached to vehicle doors, post sections and passenger compartment. After welding the reinforcing element **23** to the inner region of B-post section the engaging holes are machined.

The 4th embodiment consists of
- interlocking assemblies **30 & 6.5, 35 & 6.5B** and other interlocking assemblies **32 & 6.9, 37 & 6.9B (6.9, 6.9B** identical to **6.5)** in **Fig.** 17,
- transition regions of passenger compartment **20** and the enlarged transition regions defined by the dotted lines "a1", "b1", "b2" and "c1" along the post sections to house the engaging keys **30, 32, 35, 37** in **Fig.** 18,
- two compound assemblies such as transition regions of passenger compartment **20 &** window-guide element **6** of front door **8** and transition regions of passenger compartment **20 &** window-guide element **6B** of rear door **8B** and.

- engaging keys **30, 32, 35, 37** rigidly attached to the respective reinforcing elements **21.1** to **21.5, 21.1B** to **21.5B** of transition regions of passenger compartment **20**. The welding of reinforcing elements to the transition regions opposite the vehicle doors has the advantage of using only a single element such as **21.4, 21.1B**. Those elements can be arranged between both panels of passenger compartment. The reinforcing element **21.5B** is welded to the transition region and rear wheel case. The same reinforcing method can be employed to arrange a similar element **21.1** in the transition region and to the front wheel case.

According to the description of DE 4342038 A1 a door frame of vehicle door can be assembled, without door girder and reinforcing elements, from at least two impact beams provided with interlocking assemblies and at least one window-guide element **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**. As is customary, the window guides **6.1, 6.2, 6.1B, 6.2B** in **Figs.** 1 and 3 are made from U-shaped thin panel. As *reinforcing elements* the window-guide elements are of higher-grade tensile strength **6.1a, 6.2a, 6.1aB, 6.2aB** to:
- reinforce the U-shaped window guides of metal sheets,
- receive engaging members such as engaging hooks, engaging keys and/or engaging holes (apertures) and
- receive auxiliary parts **6.5, 6.5B, 6.6a, 6,6b, 6.7a, 6.7b, 6.8, 6.9** (not drawn) as structural element with higher-grade tensile strength.

The following auxiliary parts are fixedly attached
- **6.8, 6.9** to the front faces of both impact beams **1B, 7B** and window-guide element **6B**,
- **6.6b, 6.7b** to window-guide element **6** and impact beams **7** and
- **6.6a, 6.7a** between both impact beams **1, 7** and window-guide element **6**.

Both window-guide elements are replaceable by an U-shaped stiff window-guide element **6, 6B** in **Figs.** 2, 2A, 14 to 17. Less stiff elements **6.3, 6.3B** are normally made of panel. Alternately, very stiff window-guide element **6.3, 6.3B** serves to receive the window pane and engaging keys **15.7**.

Window-guide element **6, 6B** provided with window-guide element **6.3, 6.3B** in the door cavity in **Fig.** 2A have open ends. To maximize the stiffness of window-guide element **6, 6B** both ends are force-locking connected with each other by window-guide element **6.4, 6.4B** in the door cavity in **Figs.** 2, 14 to 17:
- after the window pane has been inserted, *or*
- by having flat profile in **Figs.** 14, 15, 17 for the purpose of receiving window pane **60, 60B** in **Fig.** 15. Later on, this window pane must be supported against falling down by securing parts.

The window-guide element **6.4, 6.4B** is useful for accommodation of engaging members **15.8**.

If extraneous weight is not that important for heavy cars, trucks and vans, the following goals for independent parts are applicable:
- the window-guide element fastened to the impact beams as reinforced door frame to receive engaging members and
- the window guides of panel to guide and receive the window pane.

To clamp with the engaging mating members the following engaging members are attached:
- **15.1, 15.2, 15.2a, 15.3, 15.3a, 15.4, 15.4a, 15.5** and **15.5a** along the vehicle roof, side rail and post sections,
- **15.3, 15.3a** and/or **15.5, 15.5a** to the *common post section* of the juxtaposed vehicle doors e.g. *B- and C- post section* of 6-door vans,
- **30** and **31** to the A-post section,

- **33, 34, 35 and 36** to the *common post section* of the juxtaposed vehicle doors,
- **33** and **34** to the C-post section,
- **15.7** replaced by at least one engaging key **15.2, 15.2a, 15.4, 15.4a, 30 to 37** along the vehicle roof,
- **15.8** replaced by at least one engaging key **15.2, 15.2a, 15.4, 15.4a, 30 to 37** along the side rail.

By means of this design engaging keys **15.1** can arbitrarily be attached to the post section equipped with door hinges.

In the following embodiments in **Figs.** 3, 4, 14 to 18 the connection of all series-connected doors with vehicle roof **17**, passenger compartment **20**, vehicle frame fastened to two side rails **18** facing each other and with the respective post sections in any collision is ensured by perfect engagement of the following engaging keys **15.1 to 15.5a, 30 to 37** with engaging holes (engaging apertures) and/or of the following engaging hooks **15.6** with reinforcing rod **17.1d**:

- engaging key **15.1**, bolted to a reinforcing element of the L-shaped A-post section, with the engaging oblong hole of window-guide element **6.1a**. This A-post section is welded to reinforcing panel **17.1c** arranged along the vehicle roof and to transverse girder **17.2d** of both facing A-post sections of both vehicle sides. This feature is applicable for window-guide element **6.2a, 6.1aB, 6.2aB** in association with the B- or C-post section.
- engaging key **15.2a**, bolted to block **6.11** of window-guide element **6.1a**, with the engaging oblong hole of reinforcing panel **17.1** arranged along the vehicle roof. This panel is welded to reinforcing plate **17.2a** of the L-shaped A-post section and to transverse girders **17.2, 17.2b** of both facing A-post sections. To cut costs the reinforcing plate **17.2a** can act as transverse girder by eliminating parts **17.2, 17.2b**. These features are applicable for window-guide element **6.2a, 6.1aB, 6.2aB** in association with the B- or C-post section.
- engaging key **15.2**, bolted to window-guide element **6.2a**, with the engaging hole of reinforcing panel **17.1a** arranged along the vehicle roof. This feature is applicable for engagement of engaging key **15.2** bolted to window-guide element **6.1a, 6.1aB, 6.2aB** with the engaging hole.
- engaging key **15.3** and engaging key **15.3a**, bolted to the legs of U-shaped housing **17.3**, with the engaging apertures of window-guide elements **6.2a, 6.1aB**. As connection element between the B-post section and the vehicle roof this U-shaped housing in the B-post section is welded to reinforcing panel **17.1b** arranged along the vehicle roof and to transverse girder **17.2c** of both facing B-post sections of both vehicle sides.
- engaging key **15.4**, bolted to the reinforcing plate of reinforcing panel **18.1** arranged along the side rail, with the engaging hole of window-guide element **6.1a**. This feature is applicable for window-guide elements **6.2a, 6.1aB, 6.2aB**.
- engaging key **15.4a** such as pin e.g. ref. to DIN660, fastened to the reinforcing plate of reinforcing panel **18.1a** arranged along the side rail, with the engaging hole of window-guide element **6.2a**.
- engaging key **15.2a** in x-y operating plane as substitute for engaging key **15.4, 15.4a** or **15.8**.
- engaging key **15.5** and engaging key **15.5a**, bolted to the legs of U-shaped housing **18.3**, with the engaging apertures of window-guide elements **6.2a, 6.1aB**. As connection element between the B-post section and the vehicle frame this U-shaped housing in the B-post section is welded to reinforcing panel **18.1b** arranged along the vehicle frame and to transverse girder **18.2** of both facing B-post sections of both vehicle sides. The belt case **26** can be housed in U-shaped housing **18.3**.

- engaging hooks **15.6**, bolted to window-guide elements **6.1a, 6.2a, 6.1aB, 6.2aB**, with the reinforcing rod **17.1d** arranged along the vehicle roof or side rail in **Fig.** 4. This rod is welded to transverse girders **17.2e, 17.2f, 17.2g** of both A-, B- and C-post sections.
- engaging keys **30, 32, 35, 37**, bolted to the respective reinforcing elements **21.3, 21.5, 21.3B, 21.5B** of the bottom transition regions of passenger compartment **20** in **Figs.** 14 to 18, with the corresponding engaging holes of auxiliary parts **6.5, 6.5B** which are rigidly attached to the respective window-guide elements **6, 6B** and the respective auxiliary parts **6.6b, 6.7b, 6.8, 6.9** (not drawn due to similarity to **6.7b**).
- engaging keys **30, 32, 35, 37**, bolted to the respective reinforcing elements **21.1, 21.4, 21.1B, 21.4B** of the top transition regions of passenger compartment **20**, with the corresponding engaging holes of auxiliary parts **6.5, 6.5B** which are rigidly attached to the respective window-guide elements **6, 6B**.
- engaging keys **30, 35**, bolted to the respective reinforcing elements **21.2, 21.2B**, which at halfway up location are fixed to the post-section-transition regions of passenger compartment **20**, with the corresponding engaging holes of auxiliary parts **6.5, 6.5B** which are rigidly attached to the respective window-guide elements **6, 6B** and the respective impact beams **1, 1B**.
- engaging keys **31**, bolted to auxiliary part **6.6a** of window-guide element **6**, with the engaging holes of (machined in) the reinforced A-post section in **Figs.** 14 to 16.
- engaging keys **36**, bolted to auxiliary part **6.8** of window-guide element **6B**, with the respective engaging holes of the B-post section reinforced by reinforcing element **23**.
- engaging keys **33**, bolted to window-guide element **6**, with the respective engaging holes in the reinforced B-post section. Similarly, the engaging keys **33** can be attached to window-guide element **6B** and the respective engaging holes of the reinforced C-post section. In **Fig.** 16 a washer **15.13** with radial teeth serves as part of engaging key **33** to improve the engaging with the inner region of the reinforced B-post section in arbitrary collision. As an integral part of a screw ref. to DIN 931 Form Z the washer won't become loose on assembly.
- engaging keys **34**, bolted to auxiliary part **6.7a** of window-guide element **6**, with the respective engaging holes of the reinforced B-post section. Similarly, the engaging keys **3e** can be attached to auxiliary part **6.9** of window-guide element **6B** and the respective engaging holes of the reinforced C-post section.

It is possible to arrange

- several pairs of engaging keys **15.3, 15.5** to the legs of U-shaped housing **17.3, 18.3** and
- several engaging keys **30, 32, 35, 37** with the same feature in the enlarged transition regions of passenger compartment **20** defined by the dotted lines "a1", "b1", "b2" and "c1" in **Fig.** 18.

By applying the associative rule for the arrangement of each interlocking assemblies the attachment of engaging key and hole to the corresponding parts is reversible.

By welding a reinforcing plate to the surface of the site of engaging member a structural reinforcement is achieved. If extraneous weight is insignificant for heavy vehicle like truck or van, replace reinforcing panel by beam or beam-rod.

Costs can be cut by using mechanical connecting parts, particularly standard parts like washer ref. to DIN125, hexagon socket head screw ref. to DIN912 etc. This is exemplified by engaging key **15.4a** as rivet ref. to DIN660. With the exception of **15.4a** each engaging key **15.1 to 15.5a, 30 to 37** comprises a screw **15.14**, a sleeve **15.11**, a number of washers built into one spacer **15.12** and a washer with a large exterior diameter **15.13** illustrated in **Figs.** 3A, 14 to 18.

Due to bigger clearances the most inexpensive engaging key **15.4a** in association with the other engaging keys **15.1 to 15.5a** is suited for engagement with the respective engaging holes. However, for perfect interengagement at low cost by limited use of the interlocking assemblies, the provision with engaging keys **15.1 to 15.8, 30 to 37** without engaging key **15.4a** is ultimately necessary.

In order to form-locking connect and ensure perfect interengagement between engaging key and engaging hole (aperture) a small tolerance zone in **Figs.** 3A, 14 to 18 must be preserved by:

- correcting the length of spacer l by removing or adding several washers and/or
- assembling a sleeve with exterior diameter d, washer with exterior diameter D and/or spacer with diameter d_R chosen from the stock of the sleeves, washers and/or spacers with different diameters.

Each engaging hook **15.6** in **Figs.** 4 and 4A comprises a hook **15.20** with interior diameter d_1 and gap s_1 smaller than d_1, a screw **15.21**, a number of washers built into one spacer **15.22**, a coil-spring washer **15.24** and a nut **15.25.** The symbols s_1, d_1 and d_2 are indicated in **Fig.** 4A. In order to ensure perfect interengagement between the engaging hooks and reinforcing rod **17.1d** with diameter d_2 smaller than s_1 a small tolerance zone in **Fig.** 4A must be preserved by:

- assembling a hook with gap s_1 chosen from the stock of the hooks with different gaps;
- assembling a rod with diameter d_2 chosen from the stock of the reinforcing rods with different diameters;
- positioning the centres of the hook hole and the reinforcing rod out of alignment; and/or
- correcting the distance l_1 by removing or adding several washers of spacer.

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[9] Research work "Vehicle Safety in 1990s" ("Fahrzeugsicherheit 90") by Institute of Vehicle Safety (German NHSTA), a Dept. of German Insurers Association, in Munich
[10] Replies of Institute of Vehicle Safety dated Feb. 17 and March 16, 1995
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[12] ADAC issue 10/1996
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Claims

1. A door for a passenger car or truck equipped with a door frame comprising
- at least two impact beams **(1, 7, 1B, 7B)** and
- at least one window-guide element **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane,

where
* the following interlocking assemblies such as engaging holes & engaging keys **(15.1 to 15.5a, 15.7, 15.8, 30 to 37)** and engaging hooks **(15.6)** & reinforcing rod **(17.1d)**, with the exception of engaging member **(15.4a)**, are equipped with adjusting device to adjust to permissible tolerances or clearances and
* the vehicle is equipped with the following compound assemblies such as vehicle door & vehicle roof **(17)**, vehicle door & side rail **(18)**, vehicle door & post section(s), vehicle door **(8)** & vehicle door **(8B)** and vehicle door & transition region **(21, 21T, 21h, 21x)** of passenger compartment **(20)**,

wherein the *adjustable interlocking assemblies* such as engaging holes & engaging keys **(15.2, 15.2a, 15.4, 15.7, 15.8)** are defined by

a) a number of engaging members arranged to vehicle roof **(17)** and side rail **(18)** and

b) the engaging mating members arranged to the window-guide element,

wherein

c) *the interlocking assemblies* are in form-locking connection, when vehicle door is closed, by the adjusting device to adjust to the permissible tolerances

d) for the purpose of perfect interengagement in the state of deformation in the event of real arbitrary collision and interlocking due to the increase of impact energy, so that all vehicle doors are
- always interlocked to protect passengers against ejection from the passenger compartment and/or intrusion of a deformed vehicle member and
- connected to vehicle roof **(17)** and side rail **(18)** of the vehicle frame to lower stress due to the increase of structural stiffness and the energy distribution.

2. A door according to claim 1, characterized by arrangement of interlocking assemblies of a compound assembly: vehicle door & vehicle member in at least two operating planes.

3. A door according to at least one of preceding claims, characterized by arrangement of
a) the engaging member to vehicle roof **(17)**
b) several engaging mating members to the upper part of the window-guide element and to define the adjustable interlocking assemblies: reinforcing rod **(17.1d)** & several engaging hooks **(15.6)**.

4. A door according to at least one of preceding claims, characterized by arrangement of
a) the engaging member to side rail **(18)**
b) several engaging mating members to the upper part of the window-guide element and to define the adjustable interlocking assemblies: reinforcing rod **(17.1d)** & several engaging hooks **(15.6)**.

5. A door according to claim 2, characterized by arrangement of
a) a number of the engaging members to a post section having a part of door lock and
b) the engaging mating members to the window-guide element of vehicle door **(8, 8B)** adjacent to the post section
to define the adjustable interlocking assemblies: engaging holes & engaging keys **(33, 34)** in two operating planes.

6. A door engaging according to at least one of preceding claims, characterized by arrangement of
a) at least one pair of the engaging members to both legs of U-shaped housing **(17.3, 18.3)** in the common post section of vehicle doors **(8, 8B)** in juxtaposition and
b) the engaging mating members to both window-guide elements of the vehicle doors.
to define the adjustable interlocking assemblies: engaging holes & engaging keys **(15.3, 15.3a, 15.5, 15.5a)**.

7. A door according to claim 6, wherein the U-shaped housing **(17.3)**, connecting the vehicle doors, post section and vehicle sides, is
- in force-locking connection with engaging members **(15.3, 15.3a)** of the vehicle doors in juxtaposition and
- in force-locking connection with the common post section of the vehicle doors, reinforcing panel **(17.1b)** arranged along the vehicle roof and transverse girder **(17.2c)** of the common post sections of both vehicle sides facing each other.

8. A door according to at least one of claims 6 and 7, wherein the U-shaped housing **(18.3)**, connecting the vehicle doors, post section and vehicle sides, is
- in force-locking connection with engaging members **(15.5, 15.5a)** of the vehicle doors in juxtaposition and
- in force-locking connection with the common post section of the vehicle doors, reinforcing panel **(18.1b)** arranged along the side rail and transverse girder **(18.2)** of the common post sections of both vehicle sides facing each other.

9. A door according to claim 2, characterized by arrangement of
a) a number of the engaging members of interlocking assemblies to a post section, whereto the vehicle door is pivotally attached, and
b) the engaging mating members to the window-guide element of the vehicle door adjacent to the post section.
to define the adjustable interlocking assemblies: engaging holes & engaging keys **(15.1, 31, 36)** in three operating planes.

10. A door according to at least one of preceding claims, characterized by arrangement of
a) a number of the engaging members of interlocking assemblies to the passenger compartment **(20)**, and
b) the engaging mating members to the window-guide element
to define the adjustable interlocking assemblies: engaging holes & engaging keys **(30, 32, 35, 37)**.

11. A door according to claim 8, wherein a belt case **(26)** is accommodated in U-shaped housing **(18.3)**.

12. A door according to at least one of preceding claims, characterized by use of one stiff U-shaped window-guide element **(6, 6B)**, both ends of which face the lower vehicle member and upper part of which faces the upper vehicle member for the purpose of accommodating their respective engaging members.

13. A door according to claim 12, wherein both ends of stiff U-shaped window-guide element **(6, 6B)** are force-locking connected with each other by window-guide element **(6.4, 6.4B)**.

14. A door according to at least one of claims 1 to 11, characterized by use of two stiff window-guide elements **(6.1a, 6.2a, 6.1aB, 6.2aB)** and the respective window guides **(6.1, 6.2, 6.1B, 6.2B)**.

15. A door according to at least one of claims 1 to 11, characterized by use of one stiff window-guide element **(6, 6B)** and two window guides.

16. A door according to at least one of claims 1 to 11, wherein the vehicle roof, accommodating the engaging members, is reinforced by a reinforcing plate, reinforcing element and transverse girder of the post sections of both vehicle sides facing each other.

17. A door according to at least one of preceding claims, wherein the engaging member comprising mechanical connection elements such as screw, rivet, washer, nut, pin, engaging rings etc. and

- an engaging hook **(15.6)** with interior diameter d_1 and gap s_1 <u>*or*</u>
- a sleeve **(15.11)** of engaging key and a washer **(15.13)** with outer diameter D,

is provided with the adjusting device to adjust the tolerances between that engaging member and the engaging mating member from outside the vehicle.

18. A door according to claim 17, wherein the front region of washer **(15.13)** has radial teeth.

19. A door according to at least one of claims 17 and 18, wherein the washer is an integral part of a screw.

20. A door according to at least one of claims 17 to 19, wherein the sleeve **(15.11)** of engaging member with exterior diameter d is governed by the condition $D \geq d \geq d_R$, where D is the exterior diameter of washer **(15.13)** and d_R is the diameter of spacer **(15.12)**.

21. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging hole arranged in window-guide element **(6.1a, 6.2a, 6.1aB, 6.2aB)** and
- an engaging key **(15.1)** rigidly attached to a reinforcing plate of the post section,

whereto the transverse girder **(17.2d)** and reinforcing panel **(17.1c)** arranged along the vehicle roof or side rail are rigidly attached.

22. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging key **(15.2a)** rigidly attached to block **(6.11)** of window-guide element **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)** and
- an engaging hole arranged in reinforcing panel **(17.1)** arranged along the vehicle roof or side rail, where the reinforcing panel **(17.1)** is rigidly attached to the post section and
  * to reinforcing plate **(17.2a)** and transverse girders **(17.2, 17.2b)** <u>or</u>
  * to reinforcing plate **(17.2a)**.

23. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging hole arranged in reinforcing panel **(17.1a, 18.1, 18.1a)** arranged along the vehicle roof or side rail and
- an engaging key **(15.2, 15.4, 15.4a)** fixed to window-guide element **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**.

24. A door according to at least one of preceding claims, wherein the compound assembly: vehicle door & vehicle member, which is vehicle roof or side rail, is provided with an interlocking assembly, in which

- a reinforcing rod **(17.1d)** arranged along the vehicle member is fixed to two transverse girders **(17.2e, 17.2f** or **17.2f, 17.2g)** and
- at least two engaging hooks **(15.6)** are fixed to window-guide elements **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**.

25. A door according to at least one of preceding claims, wherein the compound assembly: juxtaposed vehicle doors & vehicle member, which is vehicle roof or side rail, is provided with an interlocking assembly, in which

- a reinforcing rod **(17.1d)** arranged along the vehicle member is fixed to transverse girders **(17.2e, 17.2f, 17.2g)** and
- at least four engaging hooks **(15.6)** are fixed to window-guide elements **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**.

26. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging hole arranged in auxiliary part **(6.5, 6.5B)** fixed to window-guide element **(6, 6B)** and
- an engaging key **(30, 32, 35)** fixed to reinforcing element **(21.1, 21.4, 21.1B)** of the top transition region **(21)** of passenger compartment **(20)**.

27. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging key **(30, 35)** fixed to reinforcing element **(21.2, 21.2B)** of the post-section-transition region of passenger compartment **(20)** and
- an engaging hole arranged in auxiliary part **(6.5, 6.5B)** fixed to window-guide element **(6, 6B)** and impact beam **(1, 1B)**.

28. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging key **(30, 32, 35)** fixed to reinforcing element **(21.3, 21.5, 21.3B)** of the bottom transition region of passenger compartment **(20)** and
- an engaging hole arranged in auxiliary part **(6.5, 6.5B)** fixed to window-guide element **(6, 6B)** and auxiliary part **(6.6b, 6.7b, 6.8)**.

29. A door according to at least one of preceding claims, wherein an auxiliary part **(6.5C)**, adapted to the outer door-contour, is arranged to the outer door-contour to window-guide element **(6B)** and impact beams **(1B, 7B)**.

30. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging key **(37)** rigidly attached to reinforcing element **(21.4B, 21.6B, 21.5B)** of the post-section-transition region of passenger compartment **(20)** and
- an engaging hole arranged in outer door-contour-shaped auxiliary part **(6.5C)**.

31. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging key **(31, 36)** rigidly attached to auxiliary part **(6.6a, 6.8)** of window-guide element **(6, 6B)** and
- an engaging hole arranged in the post section reinforced by reinforcing element **(23)** and adjacent to the window-guide element.

32. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging key **(33)** rigidly attached to window-guide element **(6, 6B)** and
- an engaging hole arranged in the post section reinforced by element **(23)**, provided with a stud **(298)** of door lock **(248)** and adjacent to the window-guide element.

33. A door according to at least one of preceding claims, wherein the interlocking assembly comprises

- an engaging key **(34)** rigidly attached to auxiliary part **(6.7a)** of window-guide element **(6, 6B)** and
- an engaging hole arranged in the post section reinforced by reinforcing element **(23)**, provided with a part of door lock and adjacent to the window-guide element.

34. A door according to at least one of preceding claims, wherein a tailgate door **(8T)**, hood **(8h)**, sliding side-, cargo door or trunk cover **(8x)** has the same features as the vehicle door.

35. A door according to at least one of preceding claims, characterised by use of metal, compound material, glass fibre reinforced material or non-metal material for material of the engaging member, window-guide element, auxiliary part, reinforcing element and U-shaped housing.

Abstract

Thanks to the permissible tolerances and the arrangement of the adjustable interlocking assembly such as

engaging keys **(15.1 to 15.8, 30 to 37)** & engaging holes and engaging hooks **(15.6)** & reinforcing rod **(17.1d)**

to the following compound assemblies such as

vehicle door **(8)** & vehicle door **(8B)**, vehicle door & vehicle roof **(17)**, vehicle door & side rail **(18)**, vehicle door & post section(s) and vehicle door & transition regions **(21, 21T, 21h, 21x)** of passenger compartment **(20)**,

these interlocking assemblies are interlocked in the event of arbitrary collision (front-, rear-, side collision and/or rollover or mass accident), thus resolving the failure of the prior art, increasing the structural stiffness,

- protecting passengers against ejection from the passenger compartment and/or intrusion of vehicle member such as vehicle roof or vehicle door, and
- saving costs due to a *single* construction, manufacturing, testing expenditure, assembly and material supply to pass the EU- and US-Crash Tests.

All the interlocking assemblies are suitable for the engagement of tailgate-, sliding side-, cargo door, hood or trunk cover with any vehicle member in any collision.

INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part application of co-pending international application number PCT/DE 96/02120 (WO 97/18984, EP 0869878 B1) filed Nov. 7, 1996 and claiming the priority of DE 195 43 706 A1 filed Nov. 17, 1995. is revised and refiled.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all post sections (pillar portions) and the flanges of door apertures of a vehicle body thereby distributing energy to all those vehicle members, lowering stress thereof, preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) or rollover.

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*series-connected doors*"	doors of one vehicle side are series-connected
"*girder*"	panel, shell, beam etc. according to FEM and Technical Mechanics
"*window-guide elements*" of vehicle doors	window-guides **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicle members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & post section/s, vehicle door & vehicle door in engagement in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicle members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type U2, one of four types shown in **Fig.** 13.

However, all these conventional configurations do not take into account the failure of passenger protection due to the following problem cases in conjunction with disengagement of the mating parts of interengaging assemblies from each other in the event of all types of real collision (any real collision) or real rollover:

- **A** Load cases **I to V** according to Technical Mechanics/FEM in real front, side and rear collision;
- **B** Wrong assumption of the prior art for the purpose of idealizing a general side energy S or S_1 to a single energy S_x or S_{x1};
- **C** Analogy between the state of non-contact and disengagement;
- **D** Constant, small contour-clearance and assembly tolerance zones;
- **E** Large clearances of interengaging assemblies;
- **E1** The first inventions of interengaging assemblies, huge production costs and fatal injury in real collision due to large clearances;
- **E2** Large deformation of vehicle structure or door **8. 8B** in real collision;
- **E3** Large deformation of side rail **18** in real collision;
- **E4** Large deformation of upper door frame **8.17** and vehicle roof **17** in real collision;
- **E5** Intrusion of vehicle roof **17** in vehicle body **20** on real rollovers; and
- **E6** Clamping assemblies or adjustable interengaging assemblies to resolve problem case **E.**

Problem case **A**: In order to idealize an impact force $2F_1$, shown in **Fig.** 10A, imposed on a vehicle structure the following assumptions must be specified:

- let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.

Load case **I** in z-y plane in **Fig.** 5: The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all post sections, series-connected doors **8, 8B** reinforced by impact elements and interengaging assemblies of those doors and post sections, is subjected to the bending moment along the y-axis.
Load case **II** in z-x plane in **Fig.** 6: The force V exerts bending moment M_{zx} along the x-axis and rotating moment $M_y = V*b$ about the y-axis acts as torsional moment along the vehicle side.
Load case **III** in x-y plane in **Fig.** 7: The A-post section is under load of rotating moment $M_{xy} = -H*b$. The vehicle side is subjected to bending moment M_{xy} along the y-axis and buckling force H.
Subjected to the total stress of bending moments M_{zx}, M_{xy}, M_{zy}, buckling force H and torsional moments M_z, M_y in the load cases **I to III**, the vehicle side, shown in **Fig.** 8, is deformed in real front collision.
By reversibly arranging the series-connected doors **8, 8B** the same load cases are obtained for real rear collision.

Load case **IV** in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.
Load case **V** in z-x plane in **Fig.** 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column **22**, shown in **Fig.** 10A, 13, the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.
The total stress consists of the stresses in load cases **IV** and **V**.

Problem case **B**: The majority of the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases **IV** and **V** be idealized to a lateral energy S_x, shown in **Fig.** 9, or S_{x1}, shown in **Fig.** 10A, imposing on the *centre* of vehicle door, illustrated as collision type U1, shown in **Fig.** 13, despite four collision types U1 to U4 and the collision type U2 having the highest percentage of severe and fatal injuries. Nevertheless, car manufacturers and suppliers world-wide have adopted this idealized S_x or S_{x1} in inventions e.g. U.S. Pat. No. 4,307,911, U.S. Pat. No. 5,806,917, U.S. Pat. No. 5,518,290, whose shortcomings are mentioned in the following problem case **E2**.

Problem case **C**: Ref. to **Figs.** 11, 12 both end coils of compression-coil spring **19** are guided by two spring seats **19.1**. Their utmost outer nodes KN_1 and KN_{End} (not drawn) rest against both stops **19.3**, where i represents the number of coils. To survey the rolling behaviour of end coil **19** on the lower spring seat **19.1** the end coil is idealized in elements by supporting springs in reference to the nodes and by the threshold value of the distance in the "state of rolling" s < 0.1 mm. **Fig.** 12 illustrates the rolling behaviour in regard to the FEM data and test results marked with M in dependence on F_z = -790, -1000 and -3000 N:

- According to test results KN_2 to KN_5 roll on the spring seat at F_z = -790 N, but in the state of non-contact at F_z = -1000 and -3000 N.
- According to FEM data the nodes in the following states are in dependence on F_z:

F_z	State of contact	State of rolling
-100	KN_1, KN_{15}, KN_{17}	KN_1 to KN_3, KN_{10} to KN_{18}
-250	KN_1, KN_{19}, KN_{20}	KN_1, KN_{15} to KN_{23}
-1415	KN_1, KN_{17}, KN_{19}, KN_{20}, KN_{30}, KN_{31}, KN_{33}, KN_{34}	KN_1, KN_{15} to KN_{35}

The state of contact (engagement) of mating parts of interengaging assemblies, idealized by nodes of the rolling end coils and mating elements of the spring, can be transformed into the state of disengagement, when the force increases.

Problem case **D**: Recently in automotive industry, great efforts have been made to achieve (finish) a constant (uniform), small contour clearance between the outer door-contour "abcde" of vehicle door **8, 8B** and the door aperture of vehicle body **20**, shown in **Fig.** 5, in order to minimize flow noise and, particularly, to achieve sales success in co-operation with an overall impression of attractive design. In the state of assembly the contour clearance e.g. of AUDI ® vehicles is only 2.5 mm and of VW Passat ® 3.5 mm.
In order to meet the above-mentioned goal and to avoid rework or reject rate large assembly tolerances between the outer door-contour and the door aperture (opening) of vehicle body **20** must be designed.

Problem case **E**: The door lock **248**, rigidly attached to vehicle door **8**, and the striker **298**, rigidly attached to post section illustrated as B-post section in **Fig.** 10A of U.S. Pat. No 4,307,911 representing the prior art, is provided with locking clearances in x-, y- and z-direction, thus ensuring the state of door locking and the normal operation of vehicle door. For the purpose of preserving the constant, small contour-clearance,

- the position D_a to D_c of each key **128a to 128c**, rigidly attached to vehicle door **8**, and the position S_a to S_c of mating receptacle **158a to 158c**, rigidly attached to lower stiff panel **156** of side rail **18**;
- the position D_n of key **148**, rigidly attached to vehicle door **8**, and the position B_n of mating receptacle **198**, rigidly attached to post section,

must be provided with position-tolerances, larger than locking and assembly tolerances, in x-, y- and z-direction in order to avoid

1. interference with the locking operation of door lock **248** to striker **298** when closing vehicle door **8**;
2. expensive reworking at the assembly line;
3. customer complaints due to disturbing noises associated with the small distances of overlaying coils, representing the mating parts of interengaging assemblies, denoted as w ≤ 0.2 mm, shown in **Fig.** 11; and
4. high reject rate due to different references of coordinate system of vehicle door, finished by two to three suppliers and transported to assembly line, and of vehicle body **20**, finished at the assembly line. Huge costs are necessary to computerize design data of vehicle door and structure in data files, which must be evaluated by innovative programs to minimize those position-tolerances and reject rate, however, under the condition of the constant, small contour-clearance.

Problem case **E1**: According to the prior art the taper-formed key **148** and the mating receptacle **198** should be in engagement or form-locking connection to ensure energy-transmission from one post section to the other.
Because receptacle **198** and striker **298** are formed together in one piece, an adjustment of receptacle **198** changes the position of striker **298** to the door lock **248** as well as the clearance therebetween, which becomes too large or small. In order to properly latch and lock the vehicle door to vehicle structure the "interengaging" assembly is provided with large tolerance zones, thus violating the condition of the aforementioned feature.
When a vehicle is laterally crashed by a truck, the key **148** can disengage from mating receptacle **198** due to large clearance so the remaining energy totally deforms the vehicle door, whose intrusion can fatally injure the driver.

According to the prior art shown in **Fig.** 1A, contour tongues **16.1** should be in engagement with contour grooves **16.2** in order to integrate vehicle door **8, 8B** into side rail **18,** vehicle roof 17 and B-post section in side collision. Without "interengaging" assembly of the vehicle door and B-post section, the normal operation of vehicle door would be possible if the outer door-contour "abcde" were square. Regarding the recent contour design, shown in **Figs.** 5 and 18, the line "ab" is generally curve-shaped, line "bc" of front door upwardly inclined ($\beta > 90^0$) or generally curve-shaped and line "bc" of rear door generally S-shaped, so contour grooves **16.2** would interfere with contour tongues **16.1** when closing the vehicle door. Furthermore, to sustain large impact energy it is necessary to reinforce the wide contour groove by an element which, unfortunately, can't be attached to the narrow upper region of door frame **8.17.**

According to the U.S. Pat. No. 3,819,228 a bulky "engaging" bolt rigidly attached to a stiff inner panel of vehicle door **8** projects through a hole of a stiff element attached to side rail **18** when the door is in closed position. The problem of large tolerance zones remains unresolved. Moreover, the overall stylish impression spoilt by a bulky "engaging" bolt will, doubtless, not be beneficial to sales. When stepping in or out of the vehicle body while cleaning or repairing, the person can injure himself when stumbling over this bulky bolt. When closing the door the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent.

Problem case **E2**: Under the load of force F_1, shown in **Fig.** 10A, in an approx. 30^0 inclined, offset front collision against another car the vehicle structure, totally deformed, is deflected, in great extent, in the opposite x-direction and in the y-direction thus resulting in disengagement of the catching hook **148**, rigidly attached to the impact beam **1, 1B** of driver-door, and the door lock **248** from the mating recess **198** and striker **298**, all of which are rigidly attached to the B-post section, respectively, in association with the reduction of the distance between the A- and B- post section from 860 mm to 490 mm in the y-direction

and the collapse of passenger protection. Later on, the remaining energy totally deforms the driver-door too. If the car rolls over, the driver would be ejected thereout.
In a real side collision of another car into a tree, great energy totally deformed the vehicle side whose intrusion fatally injured both passengers. Obviously, the lateral force, deviating from the idealized force S_{XI}, could not force catching hook **148** to penetrate into recess **198** in order to define an "interengaging" assembly.
Both real accidents resulting in severe/fatal injuries verify the shortcomings of any patent valid only for survival chance under load of an idealized force S_{XI}, denoted by arrow A in Fig. 1 of U.S. Pat. No. 5,518,290. Taken as given, the mid region of door is secured to the B-post section by the "interengaging" assembly in an "idealized" accident, the upper, lower door frame **8.17, 8.18**, the vehicle roof **17** and side rail **18** are overstressed due to lack of interengaging assemblies. Moreover, problem cases **E3 to E6** remain unresolved.

As exemplified by U.S. Pat. No. 4,676,524, a pair of vertically supporting window-columns, rigidly mounted in both vehicle doors **8** of a convertible car is in abutting, "engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.
When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

thereby totally deforming the cowl and pair of window-columns.
The stiffness of an open roof of a convertible car, merely supported by a pair of post sections in force-locking or free connection with one pair of small-size window-columns, is

- very low, thereby resulting in fatality on a real rollover thereof;
- lower than that of a rotatable, stiff rollover bar;
- far lower than that of the closed roof **17** supported by two pairs of post sections and
- substantially far lower than that of the closed roof **17** strongly supported by three pairs of reinforced post sections.

Problem case **E3**: Due to great energy in a real side collision against column **22** of a central barrier, shown in **Fig.** 10A, 13, on a highway

- large deformation of side rail **18** and rear section of a vehicle, opposite to x-direction, caused the disengagement of the driver's less deformed vehicle door **8** from vehicle structure and later on
- the vehicle rolled over three times across the highway and down-hill, thus totally deforming vehicle structure, doors **8**, tailgate-door **8T**, out of which both rear passengers were hurled, and, alternately, opening and closing both vehicle doors **8**, out of which both front passengers were hurled out.

Grass **70** clamped between each post section and each vehicle door **8**, shown in **Fig.** 8, was an evidence for the alternate opening and closing of both vehicle doors **8** during the rollovers.

In a side collision of a car into a tree great energy totally deformed vehicle door **8** whose intrusion severely/fatally injured the passengers.

In a collision of another car into a hill great energy totally deformed the right side rail **18** thus resulting in the disengagement of the door lock **248** and, if provided, interengaging assemblies too and later on totally deforming vehicle structure during rollover. The driver was hurled out of this car.

Problem case **E4**: In front collision or crash test impact energy deforms, in general, upper door frame/s **8.17** outwards and vehicle roof **17** upwards, thereby creating a gap „o", shown in **Fig.** 8, and preventing front vehicle door/s **8, 8B** and/or vehicle roof **17** from transmitting energy to vehicle body **20**.
Three different states of deformation are reproduced in three crash tests, conducted by ADAC, of the German vehicles of the same type 40 % offset crashed at the same speed of 50 km/h against

- a very stiff barrier,
- a deformable barrier and
- another vehicle of the same type

because the uniform load, deformable property of two colliding masses, impact condition etc. are different. The gap „o " in three different sizes, shown in **Fig.** 8, verifies the above-mentioned thesis of non-transmission of energy.
In side collision impact energy deforms, in general, upper door frame/s **8.17** inwards thereby inflicting injuries on head.

Problem case **E5**: During the rollover of a car, impact energy totally deformed vehicle roof **17** whose intrusion severely or fatally injured both front passengers, whose heads were, definitely, crushed by falsely deployed airbags, and the remaining energy totally deformed vehicle body **20** and doors **8, 8B, 8T, 8x**.

Problem case **E6**: Responsive to problem case **E**, a clamping assembly illustrated in **Fig. 1B** comprises

- a stiff hook of stiff ledge **25.2** rigidly mounted to lower door frame **8.18** and
- a thin mating panel of a stiff plate **25.1**, rigidly attached along sill rail **18**, serving as a site of predetermined fracture.

In excess of predetermined value in real side accident, the mating parts **25.1, 25.2** of interengaging assemblies are in the state of clamping to ensure the permanent engagement of lower door frame **8.18** with sill rail **18** in order to resolve the problem of passenger ejection. Load cases **I to III, V** and problem cases **E2 to E5** remain unresolved. Furthermore, there is no space to house both mating parts **25.1, 25.2** in vehicle roof **17** and upper door frame **8.17** subjected to lateral load F_o in real accident. The lack of interengaging assemblies became obvious on the rollover of a sport car, which plunged seven meter downwards and crashed with vehicle roof **17** at a lower level of an underpass in Wiesbaden City thus totally deforming vehicle roof **17**, body **20** and both upper door frames **8.17** during rollover, where the remaining energy was transmitted through both head rests, integrated into the respective seatbacks, to the vehicle floor, thereby reducing the AIS of both passengers. AIS is an international acronym of Abbreviated Injury Severity ranging from 0 (no injury) to 6 (fatality).
Responsive to problem case **E**, adjustable and/or latching mechanisms are provided for interengaging assemblies, whose adjustable and/or latchable keys are bolted to the B- or C-post section, facing the termini of both reinforcing beams **1, 7** or **1B, 7B**, and whose mating receptacles are arranged thereto. Both plates **5.1, 5.2** of each hinge of vehicle door are provided with a rivet serving as key and an oblong mating hole. Owing to this feature load cases **I to IV** are resolved, but load case **V** and problem cases **E3 to E5** remain unresolved.

Evidently, due to load cases **I to V** and all problem cases **B, E, E1 to E5** "interengaging" assemblies of the remaining prior art are unsuitable for the purpose of energy-transmission and distribution by means of the integration of vehicle doors **8, 8B, 8T** into the vehicle body **20**, in conjunction with five tolerance zones proposed by U.S. Pat. No. 5,297,841, U.S. Pat. No. 4,307,911 and eight tolerance zones proposed by U.S. Pat. No. 5,806,917.

SUMMARY OF THE INVENTION

Accordingly, the principle object of the present invention is to overcome the deficiencies of the prior art by providing engagement for interengaging assembly having large clearances, which are necessary in car manufacturing and door assembly, in order

- to protect passengers against ejection from the vehicle body and/or intrusion of vehicle member and
- to increase the vehicular stiffness

in the event of any collision and/or rollover. These interengaging assembly are arranged to the corresponding vehicular couples (vehicle member & mating vehicle member).

This principle and other objects of the present invention are accomplished by the following features (proposals):

- minimum tolerances by installing and adjusting the engaging keys from outside to tightly mate the receptacles thereby ensuring the connection of the doors with all vehicle members of vehicle body **20** such as post sections, vehicle roof **17**, flange **21**, a pair of side rails **18**, fastened to vehicle floor, in any collision and/or on rollover;
- interengaging assemblies with adjusting mechanisms such as holes & keys **15.1 to 15.5a**, **15.7**, **15.8**, hooks **15.6** & reinforcing rod **17.1d** and holes & keys **30 to 37**, shown in **Fig.** 1, 3, 3A, 4, 4A and 14 to 18;
- window-guide elements to accommodate the engaging parts;
- space-saving, inexpensive design for engaging parts;
- arrangement of interengaging assemblies of a vehicular couple in at least two operating planes thus making the strict restriction of minimum tolerances less significant;
- arrangement of an U-shaped extension member having keys in the common post section of the series-connected vehicle doors, whose holes mate with the keys to ensure the engagement owing to constrained deformation thereof.

Despite the failure of the prior art in the event of real side collision any modification and extra design for survival chance in real collision and/or on rollover will generate costs, R&D expenses and weight due to the use of other inventions.

Summary of the advantages of the present invention:

A) saving labour-time by installing and adjusting engaging parts from outside the vehicle body.

B) low reject rate.

C) space-saving, inexpensive design.

D) dissimilar operating planes or at least two operating planes for each vehicular couple to ensure the engagement of its interengaging assemblies in association with energy absorption due to load cases in three different planes. **Figs.** 14 to 18 illustrate *a single vehicular couple*: window-guide element & B-post section with the interengaging assemblies: keys **34** & holes in z-x plane acting as the first operating plane, however, interengaging assemblies: keys **32, 33** & holes in z-y plane acting as the second operating plane. The specification is changed from the minimum tolerances of "narrow" to permissible tolerances of "far less narrow", thus cutting costs and time associated with less adjustment work to reduce large clearances thereto. This feature of dissimilar operating planes is applicable too for both interengaging assemblies: holes & **15.1, 15.2a** and **15.2, 15.3** and **15.4a, 15.5** etc., shown in **Fig.** 3. A row of the same keys is operative in dissimilar operating planes by arranging a number of the same keys **15.1** to the generally inclined A-post section or of keys **33** to the generally inclined B-post section. In reference to the global xyz coordinate system the key **15.2a** & hole is operative in an inclined plane.
Because the hinge bolts of the front and rear doors have an operating direction in z-axis the arrangement of interengaging assemblies: holes & keys **31, 36** to one operating plane is sufficient. However, any additional arrangement of holes & keys **30, 35** improves the engagement of vehicle mating parts and substantially decreases severe/fatal injuries in any real collision.

E) minimizing the R&D work by reducing FEM calculations, crash tests and by saving material due to the arrangement of interengaging assembly in different operating planes.

F) passenger protection for all collisions by a **single** construction, manufacturing, testing expenditure, assembly and material supply.

G) exploitation of the flange **21, 21T, 21h, 21x** of vehicle body **20** provided with sound-proofing material **21.10**, shown in **Figs.** 1, 17, 18, due to the sites to accommodate keys and the continuous stress curve. The enlargement of the flange to a limited extent neither impairs the overall stylish impression nor obstructs the passenger from ingress into or engress from the passenger compartment. Those edges (regions) of all post sections are defined by the dotted lines "a1", "b1", "b2" and "c1".

H) overall stylish impression. As substitutes of the bulky bolt ref. to U.S. Pat. No 3,819,228 small-size parts can be distributed in inconspicuous manner along the window-guide elements as well as flange, thus substantially ensuring the engagement of vehicular couple whilst lowering stress. Due to this feature it is possible to arrange the following keys:

- **30, 32, 35, 37** to the respective flange **21** of vehicle body **20**. In contrary to U.S. Pat. No. 3,819,228, this feature won't endanger passenger when stepping in or out, furthermore, more useful for passenger protection in side collision, particularly, according to collision types U1 and U2, shown in **Fig.** 13, as well as in front collision.
- **15.2a, 15.2, 15.7** e.g. with screws M4 to the narrow window-guide element **6.3, 6.3B** of upper door frame **8.17** to resolve the problem of the large, stiff contour groove of the prior art.
- **33, 34, 36** to the respective window-guide elements **6, 6B** and elements **6.7, 6.8** in engagement with the reinforced B-post section in two to three operating planes without obstructing the operation of the seat belt **26.1**, shown in **Fig.** 15. The fact, that no contact is made during the opening operation of series-connected vehicle doors, is demonstrated by the trajectories of both outer points of the washer and of the door edges drawn with dotted lines.
- **31** to the respective window-guide elements **6** and elements **6.6a** in engagement with the reinforced A-post section.

I) less stress to solve the problem of total deformation. By means of arrangement of interengaging assemblies of each vehicular couple in multi-operating planes and increase of vehicular couples comprising vehicle door & vehicle roof **17**, vehicle door & side rail **18**, vehicle door & post section/s and vehicle door & vehicle body **20** more vehicle members in compound construction are involved in energy absorption in different load cases in the event of any collision and/or rollover.
In co-operation with another prior art the structural stiffness reaches the maximum. Beyond doubt, the advantage of keys *2.1, 5.6* & mating holes is due to the further exploitation of the very stiff impact beams **1, 7** to house the corresponding parts.
Because the other vehicular couples comprising such as vehicle door & side rail and vehicle door & vehicle roof are not equipped with interengaging assemblies this *single* arrangement of one vehicular couple in mid region of door is insufficient in the event of any collision and/or rollover, therefore endangering the passengers in the following state of deformation
- intrusion of vehicle roof **17** into the vehicle body and of upper door frame **8.17**, thus squashing the passengers and
- buckling of the upper portion of the A-post section, total deformation of upper door frame **8.17**, buckling of vehicle roof **17** and buckling of side rails **18**, shown in **Fig.** 8.

In order to avoid the above-mentioned state a number of holes or keys **30 to 37** is arranged to the flange **21** *above, below* of the impact beams **1, 7** and *therebetween.* When the *non-adjustable* rivets *5.6* of the door hinges in x-z operating plane are replaced by a number of interengaging assemblies **15.1, 15.2a, 15.4, 30, 31** in numerous operating planes, the total stress of the vehicular couples: A-post section & vehicle door along the z-axis is lower owing to stress distribution, thereby preventing, to a certain extent, the A-post section and vehicle door from total deformation and gap „o", shown in **Fig.** 8.

J) measures against passenger ejection and total deformation of the vehicle members, whereby vehicle doors are not or less deformed, in real accident ref. to problem cases **E2** to **E4**, which can solely be solved by engagement of the following interengaging assemblies governed by permissible tolerances:
- holes & keys **15.3, 15.3a, 15.5a, 15.5** owing to U-shaped extension members **17.3, 18.3**, whose deformation causes a constrained deformation of the series-connected vehicle doors, vehicle roof and side rails;
- holes & keys **32, 33, 34, 30, 15.2, 15.4a** of the vehicular couple comprising vehicle door & B-post section in four operating planes; *and/or*
- hooks **15.6** & reinforcing rod **17.1d** of both vehicular couples comprising series-connected vehicle doors & side rail and series-connected vehicle doors & vehicle roof, so that the deformation of the side rail and vehicle roof causes a constrained deformation of the series-connected vehicle doors; and

by *energy transmission* into the other vehicle side by means of transverse girders **17.2, 17.2b, 17.2c, 17.2d, 18.2** of vehicle roof, side rails and all post sections facing each other, thus distributing the energy thereto.

K) passenger protection by engagement of vehicle couples in rear collision. Door detachment in rear collision occurred due to the lack of door hinges and interengaging assemblies. For the purpose of connection of vehicular members to each other the engagement of rear door **8B** with the C-post section is improved by rigidly arranging
- element **6.5C,** adapted to the outer door-contour and having holes to receive mating keys **37**, shown in **Figs. 14, 18**, to the door frame of rear door; and
- keys **33, 34** to window-guide element **6B**.

The features of vehicle door are, doubtless, suitable for tailgate door **8T**, sliding side door, liftgate door cargo door, trunk cover **8x**, hood **8h**, series-connected doors, e.g. three vehicle doors with four post sections of large van.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments, other advantages and features of the present invention will be described in the accompanying drawings with reference to the xyz global coordinate system::

Fig. 1 is a side view of vehicle side, body, impact beams, keys, hooks, window-guides and window-guide elements (reinforcing elements).

Fig. 1A is a cross-sectional view of a vehicle door engaging with a roof and side rail ref. to DE-OS 2162071 in side collision.

Fig. 1B is a cross-sectional view of a vehicle door engaging with a side rail ref. to EP 0423465 A1 in side collision.

Fig. 2 is a side view of an U-shaped window-guide element, the position of keys **15.7, 15.8** and of an additional window-guide element **6.4, 6.4B**.

Fig. 2A is a side view of an U-shaped window-guide element, the position of keys **15.7**.

Fig. 3 is a perspective view of a front stiff door frame with both window-guides, both respective window-guide elements and interengaging assemblies of the 1st embodiment.

Fig. 3A is a cross-sectional view of a key equipped with an adjusting mechanism.

Fig. 4 is a perspective view of interengaging assembly hooks & reinforcing rod of the 2nd embodiment.

Fig. 4A is a cross-sectional view of the reinforcing rod and the mating hook equipped with an adjusting mechanism.

Fig. 5 illustrates a load case I in z-y plane in front collision of vehicle.

Fig. 6 illustrates a load case II in z-x plane in front collision.

Fig. 7 illustrates a load case III in x-y plane in front collision.

Fig. 8 is a state of total deformation of vehicle at displacement v in front collision.

Fig. 9 illustrates a load case IV in x-y plane in side collision of vehicle.

Fig. 10 illustrates a load case V in z-x plane in side collision.

Fig. 10A illustrates the mating parts of interengaging assemblies ref. to U.S. Pat. No 4,307,911, both mating parts of a door lock, the general force F_1 or S_1 in the event of front or side collision and a highway column.

Fig. 11 is a view of a compression-coil spring on a lower spring seat.

Fig. 12 illustrates the projection of the end coil and spring seat in a plane, the test results and FEM data of an end coil rolling on the lower spring seat in dependence on load.

Fig. 13 illustrates four collision types U1 to U4 ref. to the research work of Institute of Vehicle Safety, a Dept. of German Insurers Association, and a highway column.

Fig. 14 is a perspective view of interengaging assemblies of the 3rd embodiment comprising a stiff front door frame having a single window-guide element and a stiff rear door frame having a single window-guide element to engage with the post sections and flange of vehicle body.

Fig. 15 is a cross-sectional view of the series-connected doors in engagement with the A-, B-post section and of the vehicle body along the line D-D in **Fig.** 14.

Fig. 16 is a side view of the series-connected stiff door frames without window pane in engagement with the B-post section according to arrow E in **Fig.** 14.

Fig. 17 is a perspective view of interengaging assemblies of the 4th embodiment comprising a stiff front door frame having a single window-guide element in engagement with the flange of vehicle body.

Fig. 18 is a side view of the flange of vehicle body provided with keys.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Ref. to **Fig.** 3 the scope of the application of the window-guide elements of vehicle door is extended to accommodate the keys of interengaging assemblies, whose mating receptacles are arranged to any (A-, B-, C- or D-) post section, flange of vehicle body, vehicle roof and/or side rail. The positions of keys and mating receptacles may be interchanged if desired.
According to the prior art a stiff door frame of vehicle door can be assembled, without door girder and reinforcing elements, from at least two impact beams provided with interengaging assemblies and at least one window-guide element **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**. As is customary, the window-guides **6.1, 6.2, 6.1B, 6.2B**, shown in **Figs.** 1 and 3, are made from U-shaped thin panel. As *reinforcing elements* the window-guide elements are of higher-grade tensile strength **6.1a, 6.2a, 6.1aB, 6.2aB** to:

- reinforce the U-shaped window-guides of metal sheets,
- receive parts such as hooks, keys and/or holes and
- receive elements **6.5, 6.5B, 6.6a, 6, 6b, 6.7a, 6.7b, 6.8, 6.9** (not drawn) as structural element with higher-grade tensile strength.

The elements **6.8, 6.9** ref. to **Fig.** 14 are fixedly attached to the front faces of both impact beams **1B, 7B** and window-guide element **6B**, the elements **6.6b, 6.7b** to window-guide element **6** and impact beam **7** and the elements **6.6a, 6.7a** to window-guide element **6** and between both impact beams **1, 7**.
Both window-guide elements are replaceable by an U-shaped stiff window-guide element **6, 6B**, shown in **Figs.** 2, 2A, 14 to 17. Less stiff elements **6.3, 6.3B** are normally made of panel. Alternately, very stiff window-guide element **6.3, 6.3B** serves to receive the window pane and keys **15.7**.
Window-guide element **6, 6B** provided with window-guide element **6.3, 6.3B** in the door cavity, shown in **Fig.** 2A, have open ends. To maximize the stiffness of window-guide element **6, 6B** both ends are rigidly connected to each other by window-guide element **6.4, 6.4B** in the door cavity, shown in **Figs.** 2, 14 to 17:

- after the window pane has been inserted, *or*
- by having flat profile, shown in **Fig.** 17, for the purpose of receiving window pane **60, 60B**, shown in **Fig.** 15. Later on, this window pane must be secured against falling down by protective parts.

The window-guide element **6.4, 6.4B** is useful for the accommodation of keys **15.8**. If extraneous weight is not that important for heavy cars, trucks and vans, the window-guide element fastened to the impact beams serves as members of door frame to receive keys while the window-guides of panel guides and receives the window pane.

One of the solutions for the problem case **E4** and energy-distribution to both post sections, door **8, 8B**, roof **17** and side rail **18** as well as from one vehicle side to the other vehicle side is featured in the 1st embodiment by arranging

- key **15.1** to a reinforcing element of the L-shaped A-post section, welded to reinforcing panel **17.1c** arranged along the vehicle roof and to transverse girder **17.2d** of both facing A-post sections of both vehicle sides, and the mating oblong hole to window-guide element **6.1a**;
- keys **15.1** to reinforced A-post section and the mating oblong holes to window-guide element **6.1a**;
- keys **15.2** to window-guide elements **6.1a, 6.2a** and the mating holes to reinforcing panel **17.1a** arranged along the vehicle roof; and

- keys **15.4** to the reinforcing plate of reinforcing panel **18.1** arranged along the side rail, and the mating holes to window-guide elements **6.1a, 6.2a.**

In case of large-sized door it is recommended to arrange additional keys **15.2, 15.4** to window-guide element **6.3, 6.4** and the mating holes to the reinforced vehicle roof and the reinforced side rail, respectively.

Ref. to **Fig.** 4 the 2nd embodiment consists of an interengaging assembly, the hooks of which are attached to two window-guide elements of each vehicle door and the mating rod to the vehicle roof, post sections of the door or all doors. The rod serves to reinforce the vehicle roof, sustain impact force and aid positioning on assembly, thus cutting costs. However, this embodiment needs space, which is available in large cars, trucks and vans. This embodiment is suited too for another vehicular couple comprising vehicle door/s & side rail.

The interengaging hooks **15.6** are bolted to window-guide elements **6.1a, 6.2a, 6.1aB, 6.2aB** and the mating reinforcing rod **17.1d** is arranged along the vehicle roof **17** and/or side rail **18**. When at least one pair of rods is welded to transverse girders **17.2e, 17.2f, 17.2g** of both A-, B- and C-post sections, energy can be distributed from one vehicle side to the other vehicle side in side collision, from the front to rear vehicle section of vehicle body **20** in front collision, from the rear to front vehicle section of vehicle body **20** in rear collision or to all parts of vehicle body **20** on rollover.

Ref. to Figs. 14, 17, 18 the 3rd embodiment consists of interengaging assemblies **30 & 6.5, 35 & 6.5B** and other interengaging assemblies **32 & 6.9, 37 & 6.9B (6.9, 6.9B** similar to **6.5**), **37 & 6.5C** for the purpose of avoiding large deformation of the edges of each door and of saving costs by exploiting the flange **21** of vehicle body **20** and the enlarged flange defined by the dotted lines "a1", "b1", "b2" and "c1". The keys **30, 32, 35, 37** are bolted to the respective reinforcing elements **21.1 to 21.5, 21.1B to 21.5B** of the flange **21** of vehicle body **20** and the corresponding holes are arranged to the housings **6.5, 6.5B** and/or auxiliary element **6.5C**, all of which are rigidly attached to the respective window-guide elements **6, 6B**, the respective elements **6.6b, 6.7b, 6.8, 6.9** (not drawn because of the similarity to **6.7b**) and/or the respective impact beams **1, 1B, 7, 7B**. The reinforcing element **21.5B** is welded to the flange and rear wheel case. The same reinforcing method can be employed to arrange a similar element **21.1** to the flange and the front wheel case.

Stiff door hinges in co-operation with impact beams **1, 7, 1B, 7B** and interengaging assemblies transmit forces of load case **I** from the front to rear vehicle section of vehicle body **20** in front collision. There is no door hinges to connect the rear door to the C-post section. To improve energy transmission from the rear to front vehicle section of vehicle body **20** in rear collision, an auxiliary element **6.5C** is attached to the impact beams **1B, 7B**. Instead of the bulky "engaging" bolt ref. to U.S. Pat. No. 3,819,228 these keys, configured in small size and distributed along the flange, neither spoil the overall design nor injure persons stepping in or out of the vehicle body.

The Technical Mechanical Method of constrained deformation is applied to secure the engagement of all vehicle parts with each other in the event of accident and to distribute impact energy thereto by means of two U-shaped extension members **17.3, 18.3**, located in common post section ref. to **Fig.** 3, whose keys **15.3, 15.3a, 15.5, 15.5a** are engaged with the mating apertures, arranged to the corresponding window-guide elements **6.2a, 6.1aB** of series-connected doors **8, 8B**, when doors are closed. This feature of the 4th embodiment prevents the disengagement of interengaging assemblies due to large inward deflection of vehicle body **20**, vehicle roof **17** or side rail **18**, above-mentioned in the problem case **E2, E3** or **E5**, when the doors are subjected to little or no deformation. As connection element of the common post section and the vehicle roof, this U-shaped extension member **17.3** is

welded to reinforcing panel **17.1b**, arranged along vehicle roof **17**, and to transverse girder **17.2c** of both facing common post sections of the vehicle sides. As connection element of the common post section and the vehicle floor this U-shaped extension member **18.3** is welded to reinforcing panel **18.1b**, arranged along the vehicle floor, and to transverse girder **18.2** of both facing common post sections of the vehicle sides. The belt case **26** can be housed in the U-shaped extension member **18.3**.

Due to the arc-travel path of the door about the mutual axis of door hinges the mating surfaces of key and receptacle of each interengaging assembly, proposed by U.S. Pat. No. 5,806,917, are configured in four tapered forms or two curved and two tapered forms, thus yielding eight tolerance zones, high manufacturing and assembling costs as well as making tight engagement impossible resulting in door detachment in accident. To resolve these problems straight (non-curved, non-inclined or non-tapered) engaging surfaces are proposed for key and receptacle. The purpose of assembling and adjusting any key, shown in **Figs.** 3, 3A, 4 and 4A, from outside of the vehicle body **20** is to substantially cut labour time and costs. Costs can be enormously lowered by using mechanical connecting parts, particularly standard parts like washer (ref. to DIN 125), hexagon socket head screw (ref. to DIN 912) etc. With the exception of **15.4a** each key **15.1 to 15.5a, 15.7, 15.8, 30 to 37** comprises a screw **15.14**, a sleeve **15.11**, a number of washers built into one spacer **15.12** and a washer with a large exterior diameter **15.13**, illustrated in **Figs.** 3A, 14 to 18. In order to ensure the engagement of key with mating hole a protrusion „x_m" and circumferential clearance „c_c", explained in the next section, must be preserved by:

- correcting the length of spacer „l" by removing or adding washers and/or
- assembling a sleeve with exterior diameter „d", washer with exterior diameter „D" and/or spacer with diameter „d_R".

If desired, the sleeve **15.11** and spacer **15.12** can be made of soundproofing material.

Each hook **15.6**, shown in **Figs.** 4 and 4A, comprises a hook **15.20** with interior diameter „d_1" and gap „s_1", smaller than „d_1", a screw **15.21**, a number of washers built into one spacer **15.22**, a coil-spring washer **15.24** and a nut **15.25**. The symbols „s_1", „d_1" and „d_2" are shown in **Fig.** 4A. In order to ensure perfect engagement of the hooks with reinforcing rod **17.1d**, having diameter „d_2" smaller than „s_1", small tolerance zones, shown in **Fig.** 4A, must be preserved by:

- assembling a hook with gap „s_1";
- assembling a rod with diameter „d_2";
- correcting the distance „l_1" by removing or adding washers; and/or
- positioning the centres of the hook hole and the reinforcing rod out of alignment.

Fig. 15 exemplifies a new feature of numerous different planes, wherein the interengaging assemblies of any vehicular couple comprising e.g. the common or B-post section and the series-connected vehicle doors **8, 8B**, operate. When the doors are closed, key **33** protrudes the mating hole by „$-x_m$" (minus sign in respect to the opposite x-direction), which is limited due to the arc-travel path of the door about the axis of door hinges. The clearances of key **33** and the mating hole are denoted by „$-y_m$" and „y_p". The protrusion „x_m", circumferential clearance „c_c" (not drawn, represented by „$-y_m$" and „y_p" in y-direction) of the mating parts of each assembly and operating plane play a significant role on tight engagement thereof in accident. In the accident, above-mentioned in the problem case **E2** or **E3**, the door becomes detached due to large circumferential clearances of all mating parts of interengaging assemblies, which operate in the same z-y plane, and large inward deflection of the vehicle body **20** or side rail **18** in the opposite x-direction, during which under the load of inertia forces of the passenger the door is opened and moved in the arc-travel path about the axis

of door hinges. Door detachment can be prevented by minimum tolerances, whereby the mating parts of interengaging assemblies of any vehicular couple, acting in the same operating plane, are governed.
In this time- and cost-saving feature against door detachment, proposed for the following embodiments, many interengaging assemblies of any vehicular couple comprising e.g. interengaging assemblies keys **32, 33, 34** & mating holes, must operate in numerous different planes, where the deformation of door **8** results in a tight engagement of keys **32, 34** with the mating holes, taken, the worse case is given, that all keys **33** fail to engage with the mating holes. The interengaging assemblies, comprising keys **32, 33, 34** & mating holes, operate in three different planes, the number of which can be increased by arranging these interengaging assemblies in the planes, which, however, are offset to each other, e.g. in offset z-y planes. The interengaging assemblies keys **35** & holes act in the fourth operating z-y plane and keys **36** & holes in the fifth operating z-x plane. Owing to this feature the minimum tolerances of "narrow" are outdated, hence, replaced by permissible tolerances of "less narrow", "far less narrow", "small" and/or "medium", thus significantly lowering the reject rate, assembly time and costs. Advantageously, a pattern of the interengaging assemblies, governed by permissible tolerances, can be issued in a table handed to assembly workers. Alternately, this pattern can be coded in the assembly program to drill, position and assemble parts thereof within the permissible tolerances. The constant, small contour clearance and the proper tolerance between door lock **248** and striker **298**, above-mentioned in the problem cases **D** and **E**, can easily be accomplished at the assembly line within short time, thus making rework as well as adjustment work superfluous. It should always be reckoned with a reject when the assembly tolerances are, unexpectedly, larger than the permissible tolerances. Adjustment work for the interengaging assemblies of the rejected car can be done outside of the assembly line, thereby preserving the production process and low reject rate. All these advantages outweigh the costs of extra material for a larger number of interengaging assemblies.
A washer **15.13** with radial teeth, serving as part of key **33**, clamps in the inner region of the reinforced B-post section in any collision or on rollover. As an integral part of a screw ref. to DIN 931 Form Z the washer won't come loose on assembly.
Costs can be cut by positioning an unadjusted key between adjustable keys, such as rivet **15.4a** ref. to DIN 660, fastened to the reinforcing plate of reinforcing panel **18.1a** arranged along the side rail. However, when the number of the interengaging assemblies is limited in a low-cost configuration, for perfect interengagement the provision with keys **15.1 to 15.8, 30 to 37** without key **15.4a** is ultimately necessary.

Large total stress of the load cases **I to III** results in total deformation (buckling) of the post sections, side rail, vehicle roof and/or doors because stress of vehicle body and doors in an arbitrary real collision can never be predetermined in the research as well as in the three crash tests, above-mentioned in the problem case **E4**. To resolve such indeterminate stress the vehicular couples comprising front post section / door **8, 8B**, rear post section / door **8, 8B**, vehicle roof **17** / door **8, 8B** and side rail **18** / door **8, 8B** must be equipped with many interengaging assemblies operating in numerous different planes, such as keys **30** & holes acting in the first operating z-y plane, keys **31** & holes acting in the second operating z-x plane, key **15.2a** & hole, shown in **Fig.** 3, acting in the third operating z-y plane and in co-operation with additional interengaging assemblies, comprising keys **15.1, 15.2, 15.3, 15.3a, 15.4, 15.4a, 15.5, 15.5a, 15.6 to 15.8, 32 to 37** & receptacles, in the above-mentioned embodiments.

Although the present invention has been described and illustrated in detail, it is clearly understood that the terminology used is intended to describe rather than limit. Many more objects, embodiments, features and variations of the present invention are possible in light of the above-mentioned teachings. Therefore, within the spirit and scope of the appended claims, the present invention may be practised otherwise than as specifically described and illustrated.

What is claimed:

1. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least one door aperture **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)** therein;

b) a mating vehicle door **(8, 8B, 8T, 8h, 8x)**, generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and

d) adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar and
- vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

2. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;

b) three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon;

d) at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

e) adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to minimum tolerances, when the vehicle doors are closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples consisting of

- vehicle door & vehicle roof (**17**),
- vehicle door & side rail (**18**),
- vehicle door & pillar,
- series-connected vehicle doors & common pillar and
- vehicle door & flange (**21, 21T, 21h, 21x**) of vehicle body (**20**)

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

3. An increased stiffness of vehicle structure comprising

a) a main vehicle body (**20**) having at least one door aperture (**20.1, 20.1B, 20.1T, 20.1h, 20.1x**) therein;

b) a mating vehicle door (**8, 8B, 8T, 8h, 8x**), generally representing a tailgate- (**8T**), sliding side-, cargo-, liftgate door, trunk cover (**8x**), hood (**8h**) or vehicle door (**8, 8B**), whose door frame, reinforced by at least two impact beams (**1, 7, 1B, 7B**), spanning the door aperture, elements and at least one window-guide (**6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**) to guide and receive a window pane, is hingedly secured to that vehicle body (**20**) for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon; and

d) adjusting mechanisms to reduce the clearances between the adjustable keys and the mating receptacles to permissible tolerances, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof (**17**),
- vehicle door & side rail (**18**),
- vehicle door & pillar and
- vehicle door & flange (**21, 21T, 21h, 21x**) of vehicle body (**20**)

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

4. An increased stiffness of vehicle structure comprising

a) a main vehicle body (**20**) having at least one door aperture (**20.1, 20.1B, 20.1T, 20.1h, 20.1x**) therein;

b) a mating vehicle door (**8, 8B, 8T, 8h, 8x**), generally representing a tailgate- (**8T**), sliding side-, cargo-, liftgate door, trunk cover (**8x**), hood (**8h**) or vehicle door (**8, 8B**), whose door frame, reinforced by at least two impact beams (**1, 7, 1B, 7B**), spanning the door aperture, elements and at least one window-guide (**6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**) to guide and receive a window pane, is hingedly secured to that vehicle body (**20**) for pivotal movement between an open and a closed position;

c) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of

- vehicle door & vehicle roof **(17)**,
- vehicle door & side rail **(18)**,
- vehicle door & pillar and
- vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

5. An increased stiffness of vehicle structure comprising

a) a main vehicle body **(20)** having at least three door apertures **(20.1, 20.1B, 20.1T, 20.1h, 20.1x)**, two of which are series-connected, therein;

b) three mating vehicle doors **(8, 8B, 8T, 8h, 8x)**, each of which generally representing a tailgate- **(8T)**, sliding side-, cargo-, liftgate door, trunk cover **(8x)**, hood **(8h)** or vehicle door **(8, 8B)**, whose door frame, reinforced by at least two impact beams **(1, 7, 1B, 7B)**, spanning the door aperture, elements and at least one window-guide **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane, is hingedly secured to that vehicle body **(20)** for pivotal movement between an open and a closed position;

c) at least one extension member **(17.3, 18.3, 23)**, mounted to a common pillar of the series-connected vehicle doors, to receive at least two keys mating to the receptacles, located on the respective reinforced portions of those doors, when closed, for exploiting the constrained deformation thereof to prevent them from popping open in the event of an accident; and

d) interengaging assemblies, each of which includes a key arranged to a reinforced portion of that door frame, facing a vehicular member of that vehicle body, and a mating receptacle located thereon, when the vehicle door is closed, to ensure the engagement of the interengaging assemblies and the connection of the vehicular couples, at least one thereof has a plurality of interengaging assemblies operating at least at two planes, consisting of
   - vehicle door & vehicle roof **(17)**,
   - vehicle door & side rail **(18)**,
   - vehicle door & pillar,
   - series-connected vehicle doors & common pillar and
   - vehicle door & flange **(21, 21T, 21h, 21x)** of vehicle body **(20)**

   thus distributing impact energy to all vehicular members, lowering stress thereof and preventing passengers from being hurled out of the vehicle in the event of an accident.

6. An increased stiffness of vehicle structure according to claim **1**, wherein the interengaging assembly of vehicle door & vehicle roof **(17)** consists of

- at least two hooks **(15.6)** mounted to the window-guide elements **(6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B)**; and
- the mating rod **(17.1d)**, serving as key, arranged along that vehicle roof and mounted to two transverse girders **(17.2e, 17.2f, 17.2g)** connecting the pillars of both vehicle sides to each other.

7. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assembly of vehicle door & side rail (18) consists of

- at least two hooks (15.6) mounted to the window-guide elements (6.1a, 6.2a, 6.3, 6.4 or 6.1aB, 6.2aB, 6.3B, 6.4B); and
- the mating rod (17.1d), serving as key, arranged along that side rail and mounted to two transverse girders (17.2e, 17.2f, 17.2g) connecting the pillars of both vehicle sides to each other.

8. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assemblies of series-connected vehicle doors & vehicle roof (17) and series-connected vehicle doors & side rail (18) consist of

- at least eight hooks (15.6) mounted to the corresponding window-guide elements; and
- two mating rods (17.1d) arranged along that vehicle roof, side rail and mounted to three transverse girders (17.2e, 17.2f, 17.2g) connecting all pillars of both vehicle sides to each other.

9. An increased stiffness of vehicle structure according to claim 1, wherein the adjustable interengaging assembly of vehicle door & pillar, whereto the door hinges are fastened, consists of

- a key (15.1) bolted to the intersection region of the pillar and roof, which is reinforced by a plate (17.1c) and transverse girder (17.2d) connecting the pillars of both vehicle sides to each other; and
- the mating hole arranged to the window-guide element (6.1a, 6.2a, 6.1aB, 6.2aB).

10. An increased stiffness of vehicle structure according to claim 1, wherein the adjustable interengaging assemblies of vehicle door & vehicle roof consist of

- a key (15.2a), bolted to an element (6.11) rigidly attached to the respective window-guide element (6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B), and a plurality of the keys (15.2), bolted to the respective window-guide elements; and
- the mating holes arranged to the vehicle roof (17), reinforced by a plate (17.1, 17.1a) and transverse plate (17.2a) connecting the pillars of both vehicle sides to each other.

11. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assemblies of vehicle door & side rail consist of

- a plurality of keys (15.4, 15.4a) mounted to the respective window-guide elements (6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B); and
- the mating holes arranged to the side rail (18) reinforced by an element (18.1, 18.1a).

12. An increased stiffness of vehicle structure according to claim 1, wherein the interengaging assemblies of vehicle door & vehicle roof and vehicle door & side rail consist of

- a plurality of keys (15.2, 15.4, 15.4a) mounted to the respective window-guide elements (6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B); and
- the mating holes arranged to the vehicle roof (17), reinforced by the plate (17.1a), and to the side rail (18), reinforced by the element (18.1, 18.1a).

13. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle doors & flange **(21)** of vehicle body **(20)** consist of

- a plurality of keys **(30, 32, 35)** bolted to the reinforced flange **(21)** of vehicle body **(20)**; and
- the mating holes arranged to the housings **(6.5, 6.5B)** rigidly attached to the window-guide elements **(6, 6B)**, elements **(6.6b, 6.7b, 6.8)** and impact beams **(7, 7B)**, respectively.

14. An increased stiffness of vehicle structure according to claim **1**, wherein an element **(6.5C)**, whose contour is adapted to the door-contour, is rigidly attached to the window-guide element **(6B)** and impact beams **(1B, 7B)**.

15. An increased stiffness of vehicle structure according to claim **14**, wherein the adjustable interengaging assemblies consist of

- a plurality of keys **(37)** bolted to the rear flange **(21)** of vehicle body **(20)** reinforced by an element **(21.4B, 21.6B, 21.5B)**; and
- the mating holes arranged to the door-contour-shaped element **(6.5C)**.

16. An increased stiffness of vehicle structure according to claim **1**, wherein the hook **(15.6)**, adjustable from outside the vehicle, comprises a screw **(15.21)**, a number of spacers **(15.22)**, washer **(15.24)**, nut **(15.25)** and a hook with interior diameter „d_l" and gap „s_l".

17. An increased stiffness of vehicle structure according to claim **1**, wherein the key, adjustable from outside the vehicle, comprises mechanical connection elements such as a screw **(15.14)**, large washer **(15.13)** with outer diameter „D", a number of spacers **(15.12)** and a sleeve **(15.11)**, both have a total length „l".

18. An increased stiffness of vehicle structure according to claim **17**, wherein the sleeve **(15.11)** of the key with exterior diameter „d" is governed by the equation „D" ≥ „d" ≥ „d_R", where „D" is the exterior diameter of washer **(15.13)** and „d_R" is the diameter of spacer **(15.12)** and sleeve.

19. An increased stiffness of vehicle structure according to claim **17**, wherein the front region of washer **(15.13)** has radial teeth.

20. An increased stiffness of vehicle structure according to claim **17**, wherein the washer is an integral part of a screw.

21. An increased stiffness of vehicle structure according to claim **1**, wherein both ends of the U-shaped window-guide element **(6, 6B)**, facing the lower vehicular member of vehicle body **(20)**, and an upper portion of that window-guide element, facing the upper vehicular member of vehicle body **(20)**, accommodate the members of interengaging assemblies.

22. An increased stiffness of vehicle structure according to claim **21**, wherein both ends of the respective stiff U-shaped window-guide element **(6, 6B)** are connected to each other by an element **(6.4, 6.4B)**.

23. An increased stiffness of vehicle structure according to claim **1**, wherein the window-guides **(6.1, 6.2, 6.1B, 6.2B)** are rigidly attached to the respective stiff window-guide elements **(6.1a, 6.2a, 6.1aB, 6.2aB)**.

24. An increased stiffness of vehicle structure according to claim **1**, wherein the adjustable interengaging assemblies of vehicle door & pillar, whereto the vehicle door hinges are fastened, consist of

- a plurality of keys **(31, 36)** bolted to an element **(6.6a, 6.8)** rigidly attached to the window-guide element **(6, 6B)** and impact beams **(1, 1B, 7, 7B)**; and
- the mating holes arranged to the pillar reinforced by an extension member **(23)** and adjacent to that window-guide element.

25. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

- at least one pair of keys **(15.3, 15.3a)** bolted to both legs of extension member **(17.3)** mounted to the common pillar, reinforced by a plate **(17.1b)**, arranged along the vehicle roof **(17)** and attached rigidly to a transverse girder **(17.2c)**, connecting the common pillars of both vehicle sides to each other; and
- the mating holes arranged to both window-guide elements of series-connected vehicle doors adjacent to that common pillar.

26. An increased stiffness of vehicle structure according to claim **2**, wherein the adjustable interengaging assemblies of series-connected vehicle doors & common pillar are defined by

- at least one pair of keys **(15.5, 15.5a)** bolted to both legs of extension member **(18.3)** mounted to the common pillar, reinforced by an element **(18.1b)**, arranged along the side rail **(18)** and attached rigidly to a transverse girder **(18.2)**, connecting the common pillars of both vehicle sides to each other; and
- the mating holes arranged to both window-guide elements of series-connected vehicle doors adjacent to that common pillar.

27. An increased stiffness of vehicle structure according to claim **26**, wherein a belt case **(26)** is accommodated in the extension member **(18.3)**.

28. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8)** & pillar, operating in two planes, are defined by

- a plurality of keys **(33)** bolted to the window-guide element and a plurality of keys **(34)** bolted to an element **(6.7a)** rigidly attached to the window-guide element **(6)** and impact beams **(1, 7)**; and
- the mating receptacles arranged to the reinforced pillar.

29. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & pillar, operating in three planes, are defined by

- a plurality of keys **(15.1)** rigidly arranged to the reinforced pillar, whereto the door frame is hingedly secured, and a plurality of keys **(30, 31, 35, 36)** rigidly arranged to the reinforced flange of vehicle body **(20)**; and
- the mating receptacles arranged to the window-guide element **(6.1a, 6.2a)**, elements **(6.6a, 6.8)** and housings **(6.5, 6.5B)**, respectively.

30. An increased stiffness of vehicle structure according to claim **3**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & side rail **(18)**, operating in three planes, are defined by

- a plurality of keys **(15.4a)** rigidly arranged to the side rail **(18)** and at least two keys **(30, 32, 35, 37)** rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and
- the mating receptacles arranged to the window-guide elements **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)**, door-contour-shaped element **(6.5C)** and housings **(6.5, 6.5B)**, respectively.

31. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of vehicle door **(8, 8B)** & vehicle roof **(17)**, operating in four planes, are defined by

- a plurality of keys **(15.2, 15.2a)** rigidly arranged to the respective window-guide elements **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)** and at least two keys **(30, 32, 35, 37)** rigidly arranged to the reinforced flange **(21)** of vehicle body **(20)**; and
- the mating receptacles arranged to the reinforced vehicle roof **(17)** and that window-guide elements, respectively.

32. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of connecting vehicular couples, operating in multi-planes, are defined by

- a plurality of keys **(15.1 to 15.7, 30, 32, 35, 37)** rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and
- the mating receptacles arranged to the reinforced portions of vehicle doors, respectively.

33. An increased stiffness of vehicle structure according to claim **5**, wherein the interengaging assemblies of series-connected vehicle doors & common pillar, operating in multi-planes, are defined by

- a plurality of keys **(15.3, 15.3a, 15.5, 15.5a)** rigidly arranged to the extension members **(17.3, 18.3, 23)** of the common pillar and a plurality of keys **(33, 34, 36)** rigidly arranged to the reinforced portions of series-connected vehicle doors, respectively; and
- the mating receptacles arranged to the reinforced portions of series-connected vehicle doors and the reinforced common pillar, respectively.

34. An increased stiffness of vehicle structure, characterised by use of metal, compound material, glass fibre reinforced material or non-metal material for material of the engaging key, receptacle, window-guide element, element, transverse girder, rod, plate and extension member.

ABSTRACT

On closing the door, that is conventionally hinged to the vehicle body, keys of interengagable assemblies smoothly engage with mating receptacles located on both pillars, the vehicle roof and side rail. The smooth interengagement is ensured by the adjusting mechanisms of the keys, located on the front, rear, upper and lower reinforced portion of the door, to reduce large clearances between them and their receptacles to minimum tolerances. In an accident the door tightly mates with the door-aperture of vehicle body whereby energy is distributed to the integrated vehicle body.

In the second feature of invention, the interengagable assemblies of a vehicular couple, consisting of the portion of the door and a member of the vehicle body, are arranged in at least two operating planes.

In the third feature, the deformation of the series-connected doors and their common pillar is constrained in an accident owing to an extension member, rigidly attached to the common pillar, accommodating the keys, which tightly mate with the receptacles located on the rear portion of the front door and the front portion of the rear door.

In the fourth and fifth feature, the interengagable assemblies of the vehicular couple are arranged in multi-operating planes thus cutting costs associated with less adjusting work to reduce large clearances to small tolerances.

This inventive technology is applicable for other door-types such as tailgate-, sliding side-, cargo-, liftgate door, trunk cover and hood to define a substantially stiffer vehicle body whereby stress is enormously decreased in an accident.

Fig. 1B

Prior Art

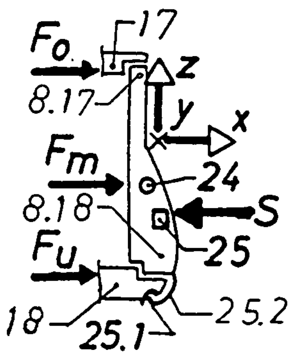


Fig. 1A

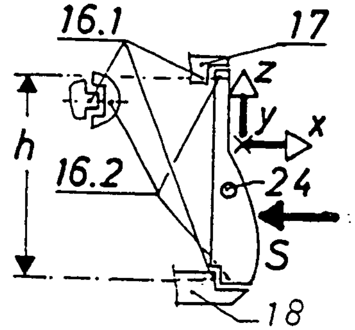


Fig. 1

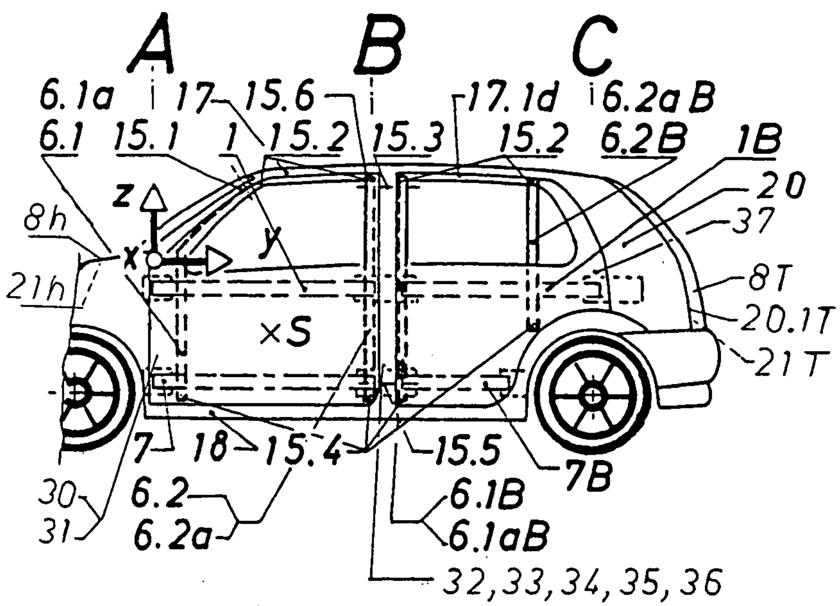


Fig. 2

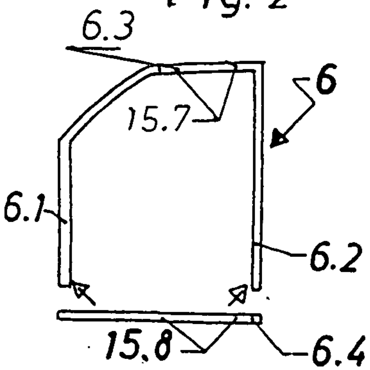


Fig. 2A

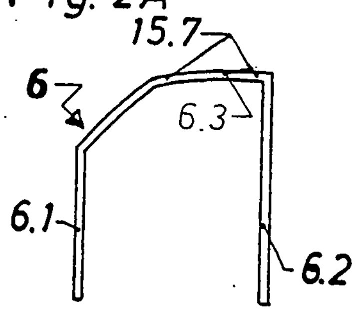
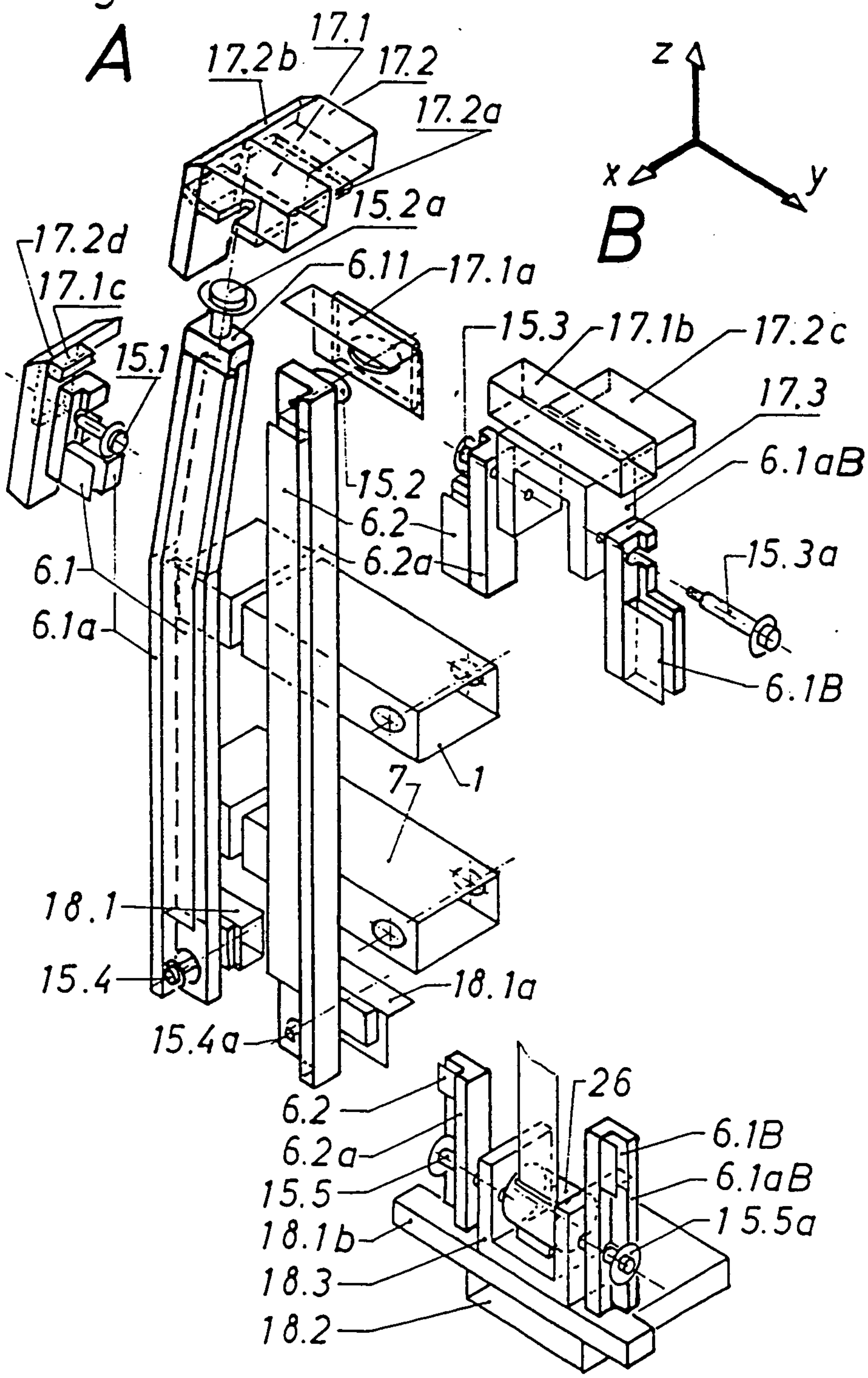


Fig. 3


A
B
z
x
y
17.1
17.2b
17.2
17.2a
15.2a
17.2d
17.1c
15.1
6.11
17.1a
15.3
17.1b
17.2c
17.3
6.1aB
15.2
6.2
6.2a
6.1
6.1a
15.3a
6.1B
1
7
18.1
15.4
18.1a
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26
6.2a
6.1B
15.5
6.1aB
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15.5a
18.3
18.2

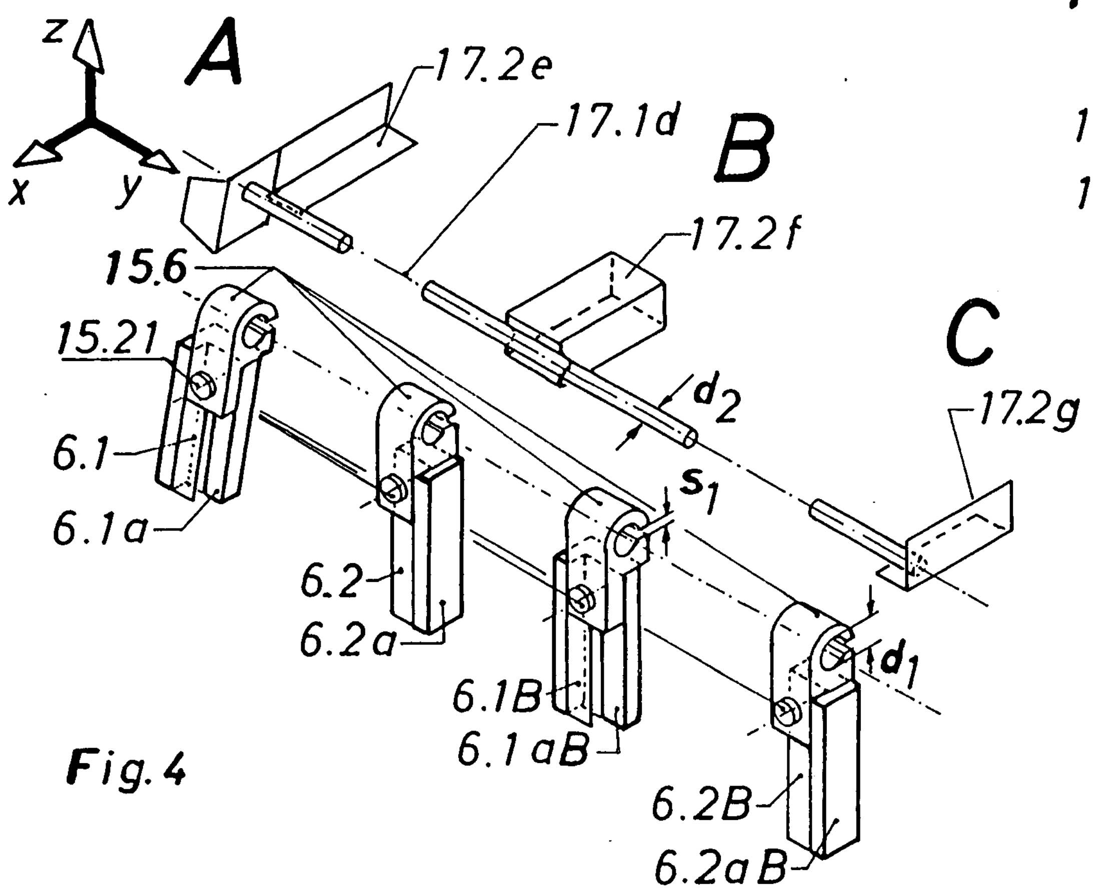


Fig. 4

Fig. 4A

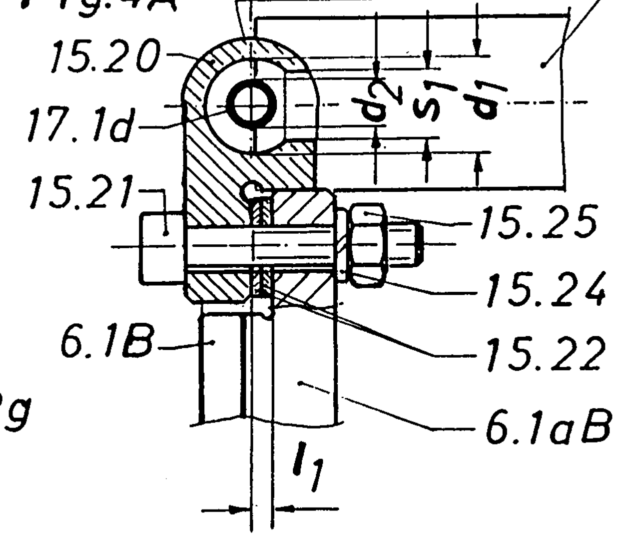
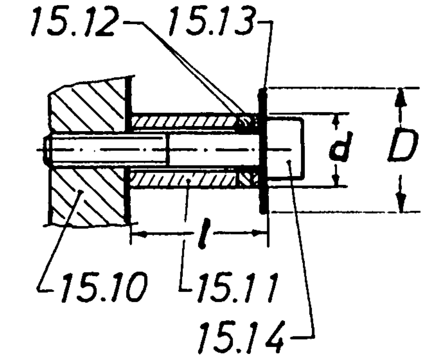


Fig. 3A



Prior Art

Fig. 5

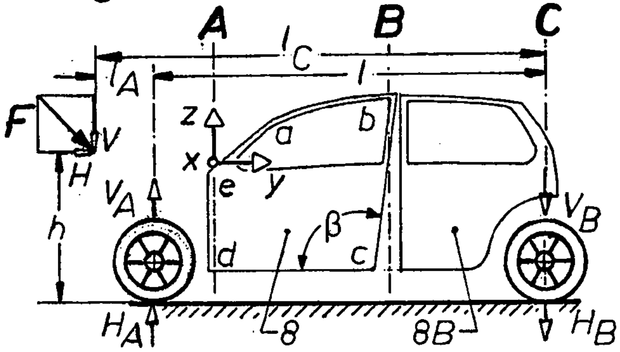


Fig. 6

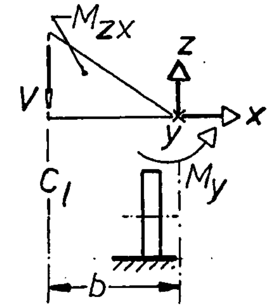


Fig. 7

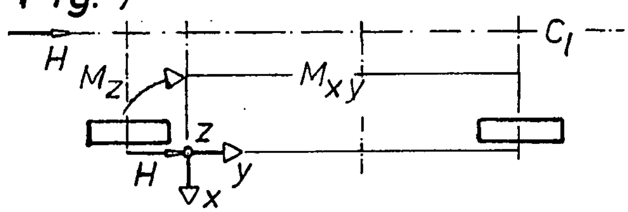


Fig. 8

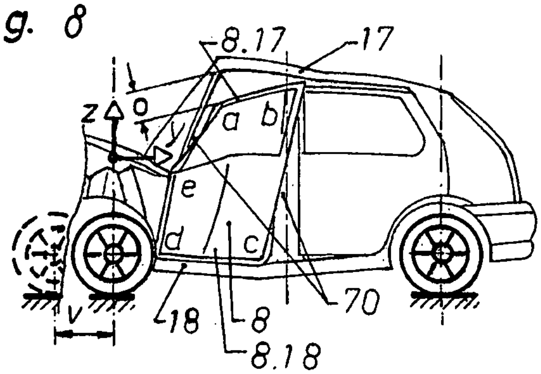


Fig. 9

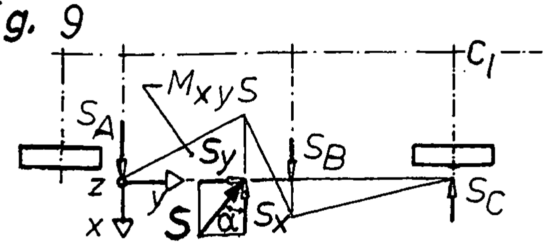
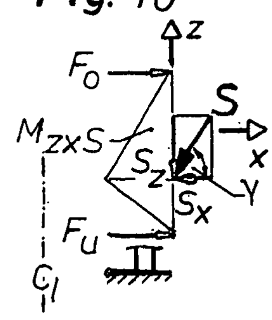
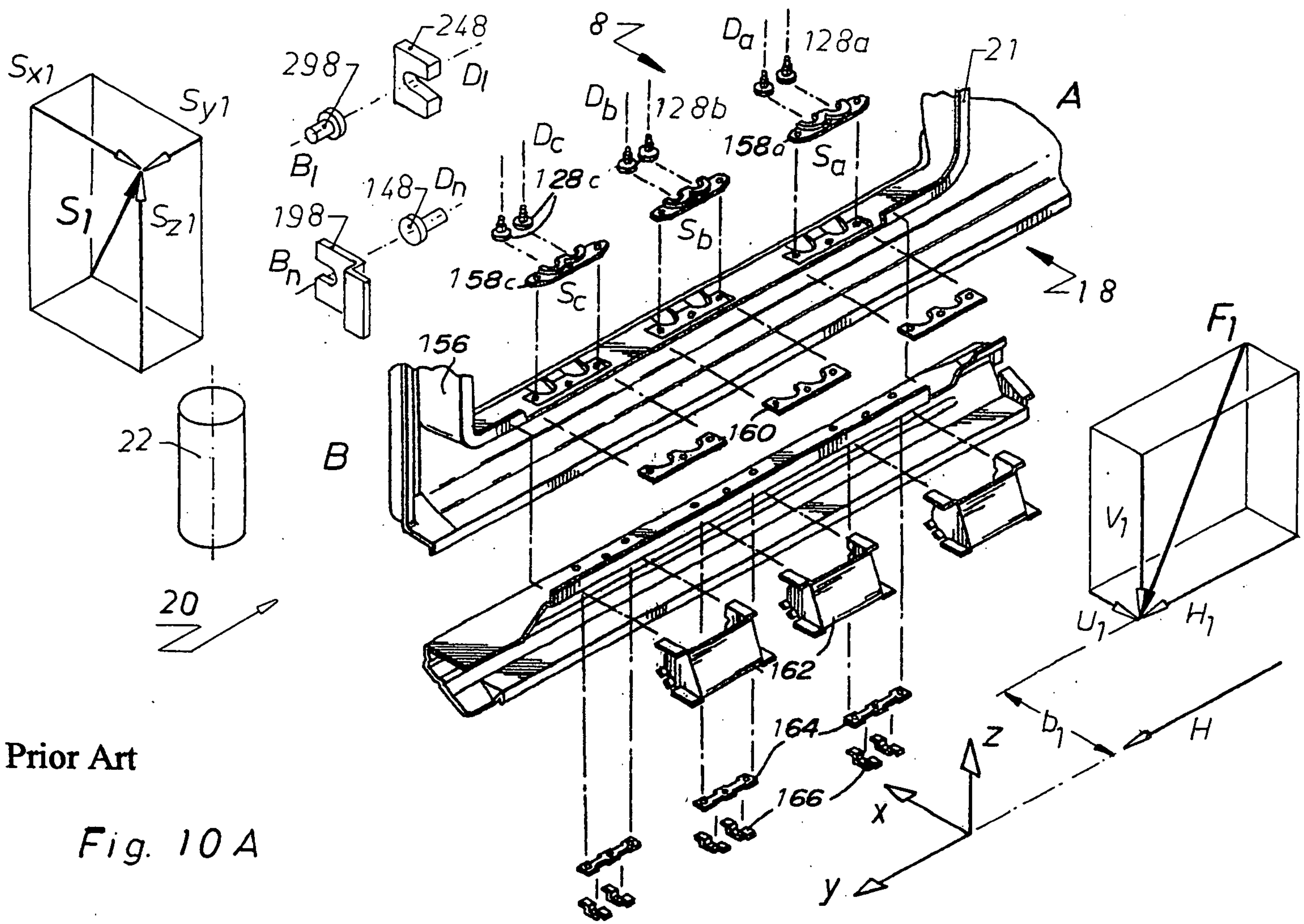


Fig. 10





Prior Art

Fig. 10A

Prior Art

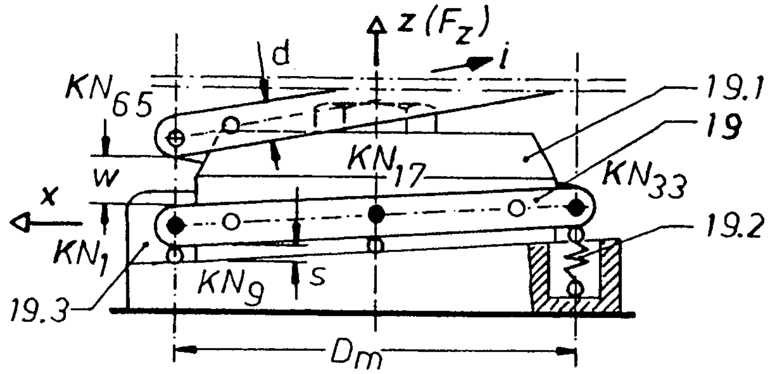


Fig. 11

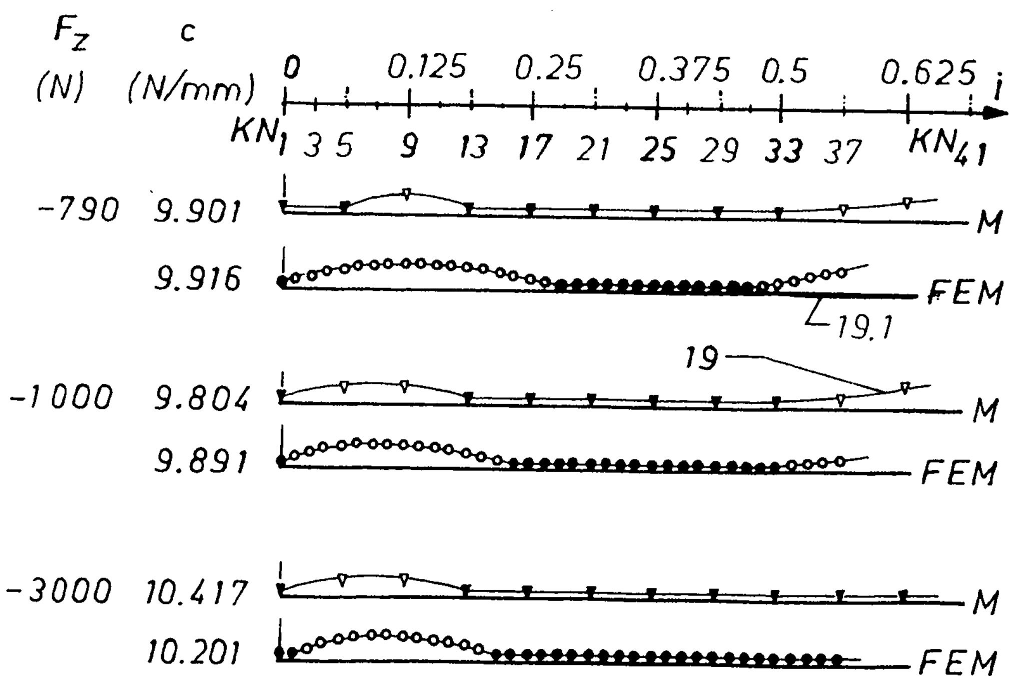


Fig. 12

Fig. 13

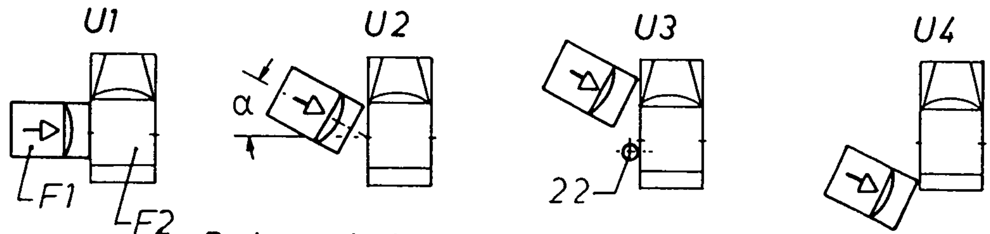

U1
U2
U3
U4
α
F1
F2
22
Prior Art

Fig. 14

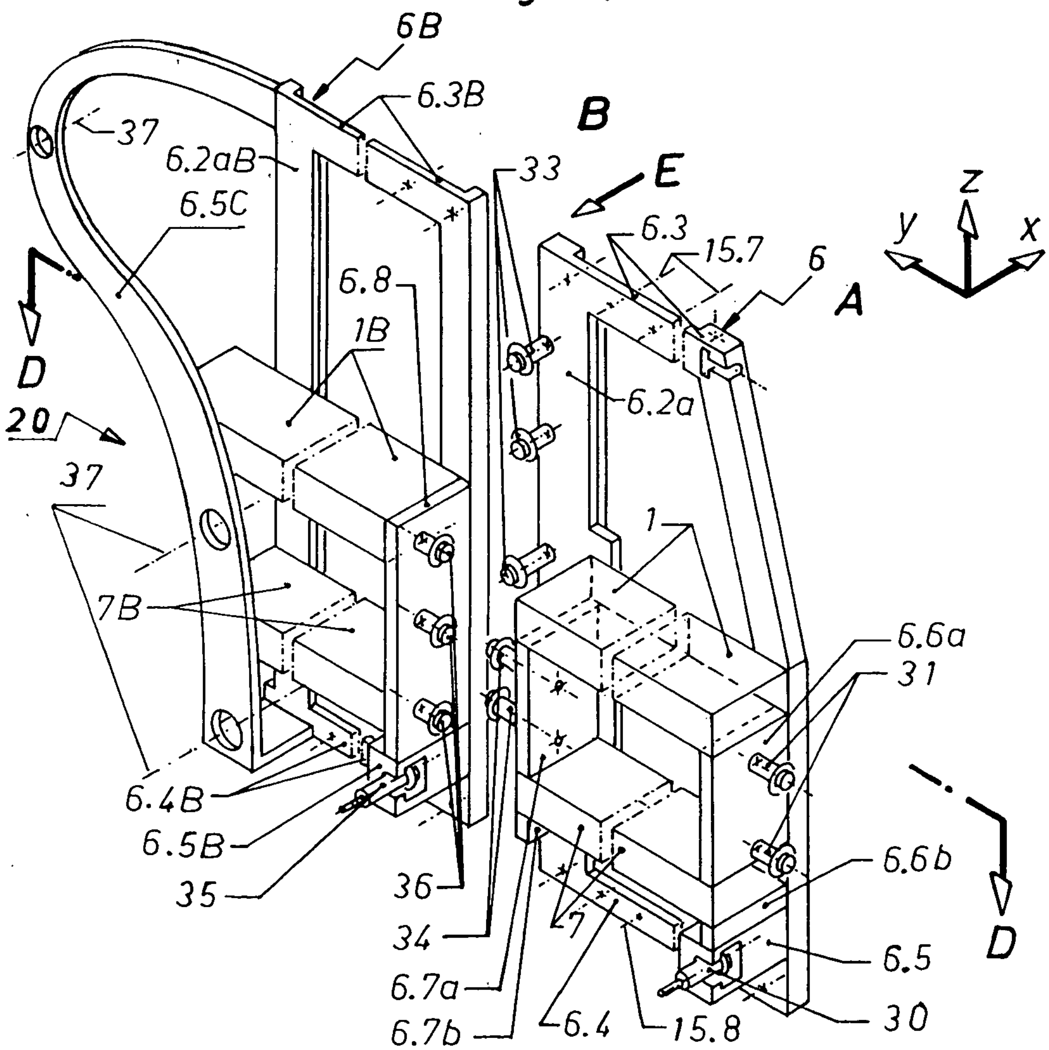
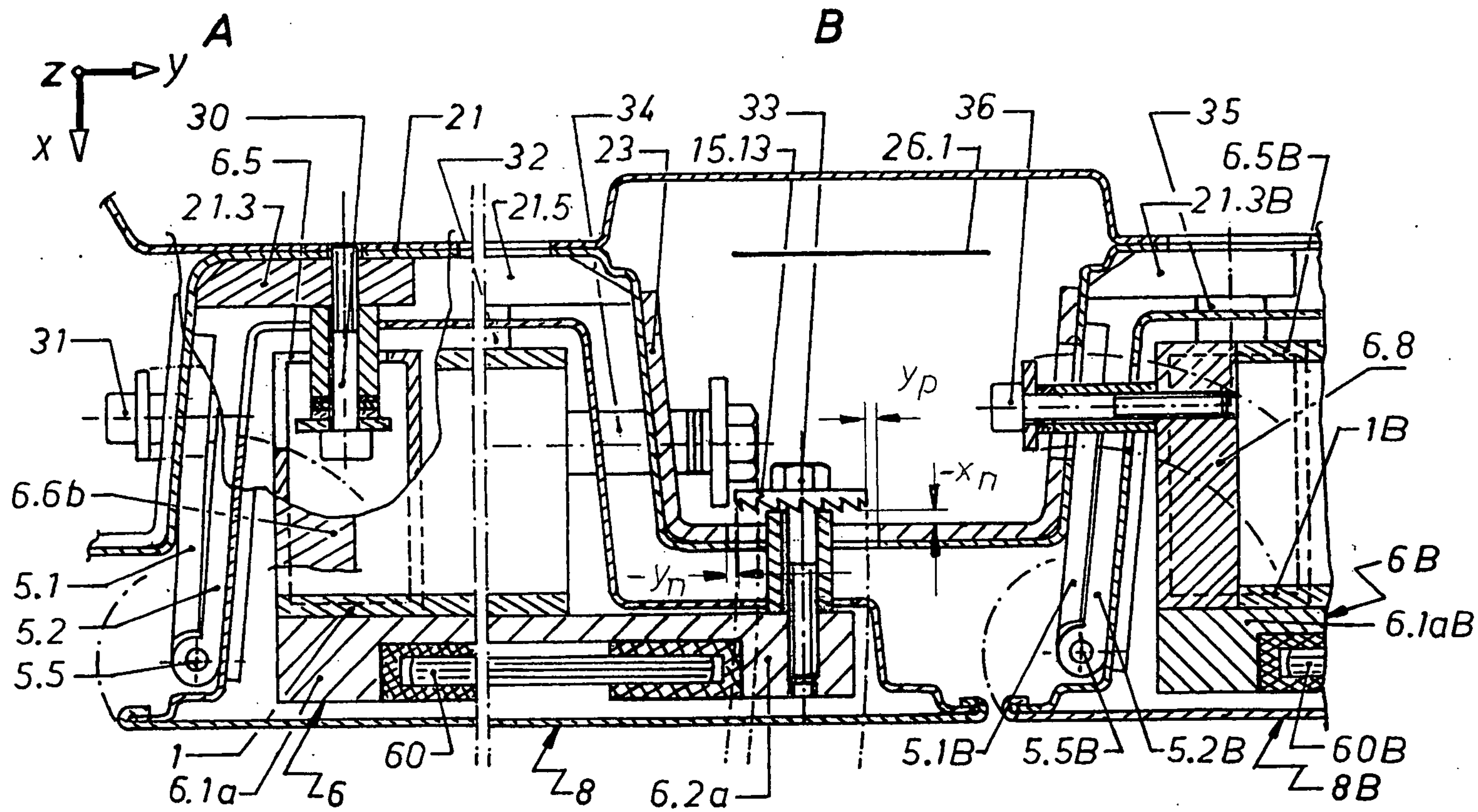

6B
6.3B
B
37
6.2aB
33
E
6.5C
6.3
15.7
6
A
z
y
x
6.8
1B
D
6.2a
20
37
1
7B
6.6a
31
6.4B
6.5B
35
36
34
6.6b
6.5
D
7
6.7a
6.7b
6.4
15.8
30

Fig. 15



A
B
z
y
x
30
6.5
21.3
21
32
21.5
34
23
15.13
33
26.1
36
35
21.3B
6.5B
31
6.6b
5.1
5.2
5.5
6.8
1B
6B
6.1aB
y_p
$-x_n$
$-y_n$
1
6.1a
6
60
8
6.2a
5.1B
5.5B
5.2B
60B
8B

Fig. 16

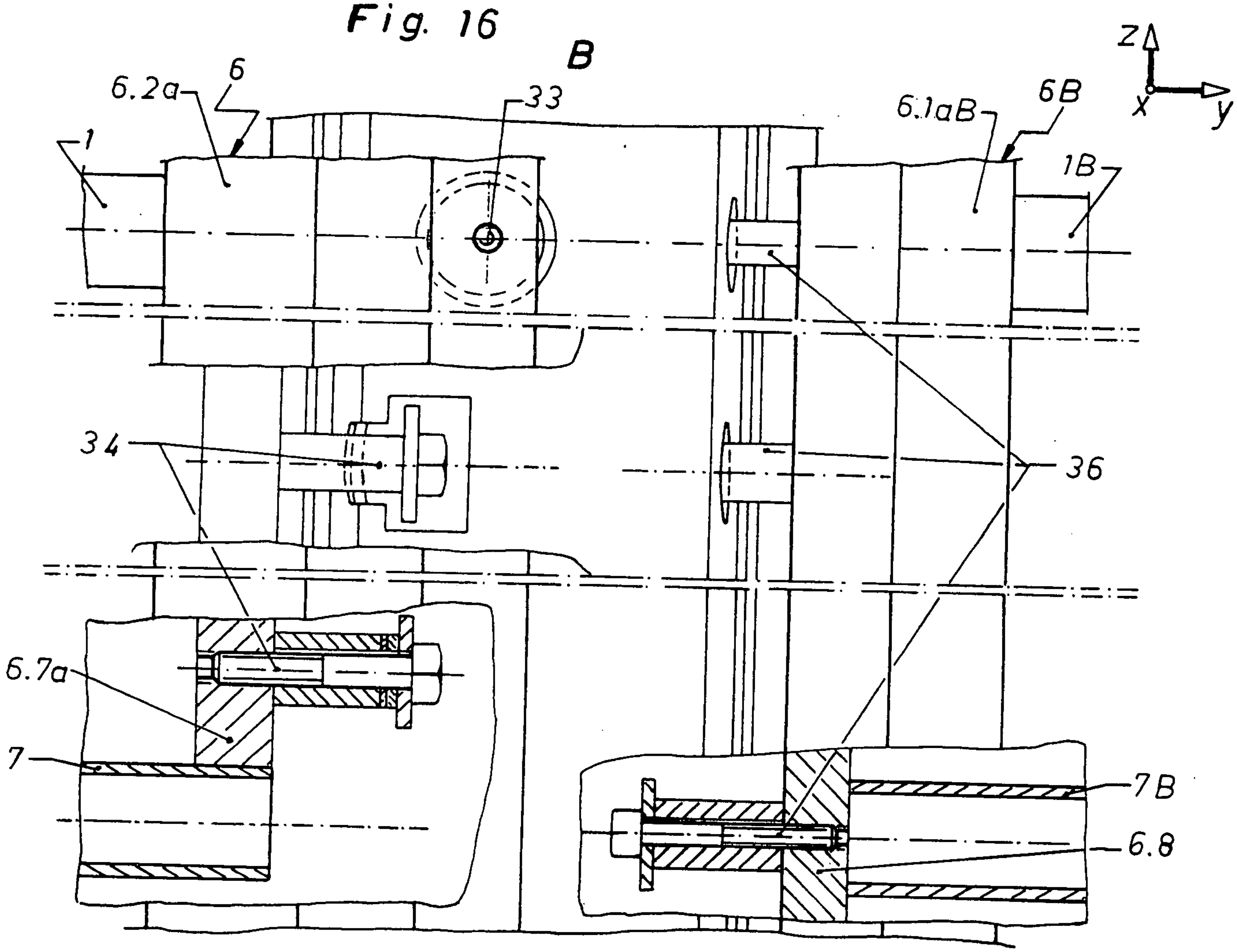
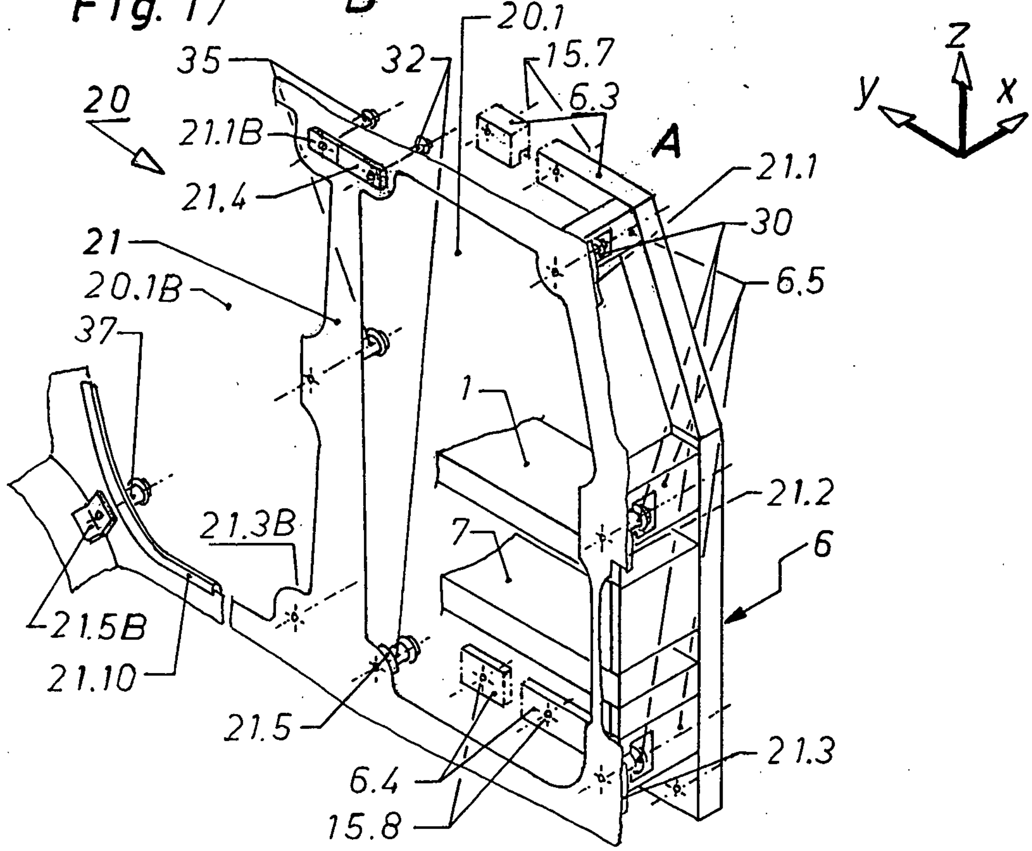
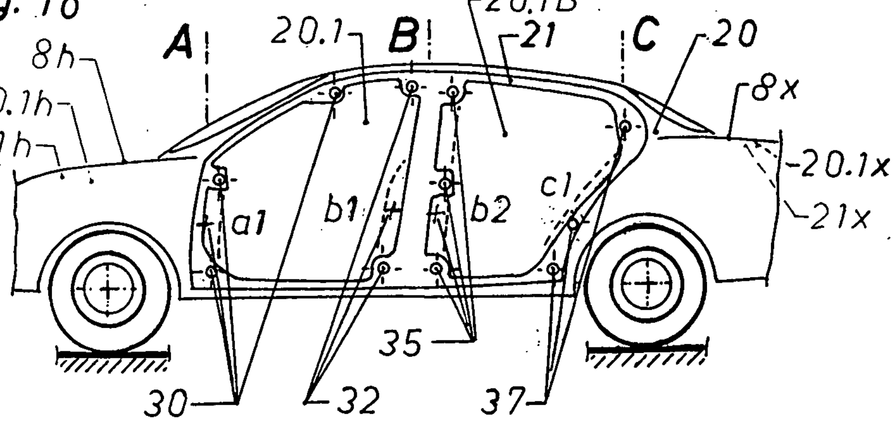


Fig. 17



B
20.1
35
32
15.7
6.3
20
21.1B
A
21.1
21.4
30
21
6.5
20.1B
37
1
21.2
21.3B
7
6
21.5B
21.10
21.5
21.3
6.4
15.8
z
y
x

Fig. 18



20.1B
A
20.1
B
21
C
20
8h
8x
20.1h
21h
20.1x
21x
a1
b1
b2
c1
35
30
32
37

E.V.

E 24a

"A million injuries and $ billion loss per year due to failure of prior art and insufficient R&D work"

Dr. -Ing. Giok Djien Go
GOT[1] in D-65510 Idstein, Germany

Preface and Copyright Information

The EU-Commission, GDV[2] and IIHS[3] have acknowledged the three-digit $ billion expenditures, cited in Chap. 3, for over one million road victims per year. Ref. to pp. 38 of TIME of Jan. 12, 98 the US-Federal Government is spending money on research of road rage, whereon the US-Congress held hearings, due to the increase of road victims and physical/social/economical loss. Collapse of vehicle structure of Chevrolet Trans Sport/Opel Sintra, failure of airbag of **four-month-old** Opel Astra B **having passed the NCAP test**, *one-year-old* MB C, Volvo, passenger ejection of AUDI A6[4], *brand-new* BMW 5, *brand-new* VW VR6, Ford, Chrysler, intrusion of deformed vehicle side/door of BMW 3, BMW 7, MB 190, Opel Corsa and of power plant (drive assembly) of Honda, VW Golf III in crash tests and real accidents as well as failure of lap belts and seats in turbulence-related incidents and landing crashes of aeroplane etc. **question** the prior art, R&D work and specs of EU- and US-Crash tests incl. SAE AS 8049 and JAR 25.561 to 25.785.

The live-saving report is subject to change without notice and shall be understood as a **commitment** to minimize injury-severity level, number of injuries and injury-related costs, **over $ 1 billion per day**, in real accidents by substantiating failure of prior art, insufficient specs of EU- and US-Crash tests and R&D work, regardless of the proprietors, Administrations and Corps., in order to claim the live-saving requirements.

 2nd version[5]

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[1] GOT is an acronym of Guard Occupants Technologies.
[2] On behalf of German Insurance Association, GDV in Munich, closely working with NHSTA, investigates and evaluates injury-related accidents in order to recommend how to decrease injuries and injury-severity level. See A19.
[3] IIHS is an abbr. for Insurance Institute for Highway Safety in Arlington, USA.
[4] The **prominent AUDI A6-victim** Rudolf Dressler serves as an executive member of SPD and German Parliament.
[5] Due to new facts and the contribution of **Stuart Forbes** BA Honours of Oxford, to whom the author/inventor owes

This live-saving report of 14 pages and 39 enclosures is dedicated to my parents Slamet Sudirga (Khoen Liang Go)[6] in Scarborough, Canada.

1. Injury-related cases

Passengers are severely/fatally injured by at least one of the following cases:

I. *yaw acceleration* $\ddot{O}$ in the event of arbitrary offset collision such as FK3, FK4, SK2 to SK4, HK3, HK4 (A1)[7] evaluated by GDV. See accident and test reports (A2 to A11, B7), Table 1 and 2 (A12);

II. *yaw- and roll acceleration* $\ddot{U}_y$ in the event of arbitrary collision and rollover (overturn) ref. to Fig. 3 of attached DE 19749780 thus fatally injuring passengers of MB E320 (A3, A4, A7), BMW 5 (B4a), VW VR6 (B5), Ford (B6), AUDI A6 (A9), (Chap. 1.3);

III. *accelerations* which at the car-speed over 100 km/h in the event of arbitrary collision and/or rollover are greater than the EU- and US-threshold values/limits at 54 to 64 km/h (Chap. 1.3d);

IV. *whiplash/reverse-acceleration causing strong whiplash* (Chap. 1.3a) and *costs* (Chap. 3);

V. *oscillation of head and upper member of body* (Chap. 1.3);

VI. *failure of seat belts and front airbags and/or false deployment of airbags* (A3, A4, A7 to A9), BMW 5 (B4a), front airbag of VW Jetta (B10c) driven backwards decapitating a baby in a real rear collision, extremely hot front airbag of Volvo (B10a) inflicted burns of the 1st and 2nd degree on a Dutch female driver, (Chap. 1.2a to 1.2b, 1.3d);

VII. *sensors of front airbags* incapable of responding to a signal of yaw acceleration e.g. of MB C (A3, A4, A6, A8) and Opel Astra B (A3 to A5, A8) in the event of skidding on a wet highway. Sensor of front airbag is designed to calculate a velocity signal Δv, which is the difference between two velocities of car in each time interval, and/or acceleration signal Δb, which is the difference between two accelerations within this time interval in *longitudinal direction*. When the signal Δv and/or Δb exceed(s) the predetermined magnitude(s), the initial inflation of airbag is determined. The problem of how to detect the signal(s) in yaw- and/or roll-related accident (angular, less than 20 % offset front- and/or gyrating collision) is unresolved in automotive industry. See Spiegel 29/96 reporting an on-a-road-front collision of Opel Astra, resulting in *severe/fatal* injuries, against MB SL, resulting in *minor* injuries, and the critical opinion on airbags/sensors by PARS, manufacturing sensors and airbags, admitting increasing false deployments and by well-known experts Dipl. -Ing. Ingo Kalina of MB acknowledging the problem of false deployment, Dipl. -Ing. Jürgen Klenk of Opel admitting four cases of false deployment and accident-expert Dr. Ulrich Löhne finding no explanation to the death of Opel's co-driver despite being restrained and seated to the *non-crashed* vehicle side. See the same phenomenon discovered by GDV (Chap. 1.3, A19) and my analyisis (Chap. 1.3a to 1.3e);

VIII. *sensors of front airbags* wrongly responding to a signal of roll acceleration e.g. of MB E320[8] (A3, A4, A7) in rollover thus decapitating both passengers in the event of rollover, and to a signal of deceleration e.g. of MB S280 in an initial brush with a Fiat Uno resulting in, presumably, a premature and explosive deflation of both front airbags, stunning, deafening, blinding Paul, the driver of MB S280 of al Fayed/Diana, and obstructing his sight at the critical moment before crashing against the 13th bridge-column ref. to TIME Sept. 7, 98. False deployment of at least one of six to eight front and/or side airbags implemented in a "very safe" car may cause accident;

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[6] My father, having served as Chairman of Buddhist Association in Jakarta, Indonesia for more than two decades, and my mother, badly experiencing from the minor injury due to falling on a hard wet floor, similar to a car, whose airbags cannot be deployed, skidding on a wet road, feel obliged to save life by supporting my R&D work. My plunging through an aperture in a construction site resembles the helpless lap-belted passengers in turbulence-related incidents. Bad experiences determine me to find out the causation e.g. for both cases and measures/inventions thereagainst listed in Chap. 1.3a to 1.3h.

[7] Both parentheses (A1) denote ref. to A1.

[8] Abundant photos of accident-involved safe/safest cars MB E320, MB C, VW VR6, Opel Astra B etc. are suited for

IX. *sensor of side airbag* incapable of responding to each deflection of outer panel of door resulting in severe injury in real side collision e.g. of a police car (Opel Vectra) against a lamp post ref. to AMS[9] 12/96 pp. 50 and Spiegel 29/96 pp. 156. Ref. to Chap. B2 of EP 0844939 B1[10] the kinetic energy of 12 litre side airbag of Volvo, equivalent to 900 kg VW Golf at 5.1 km/h, bombs out head upon false deployment. Sensor of side airbag, consisting of a number of layers, is capable of conducting current for the purpose of identifying the deflection of a specific site of outer panel provided therewith in side collision. A high number of sensors is necessary for identifying the deflection of the *whole* outer panel, thus making the installation very costly;

X. *explosion of airbags* stunning, blinding and obstructing the driver from further driving and making passengers deaf forever. EU-threshold value of explosive loudness 140 dB is exceeded by 27 dB during the explosion of one front airbag of VW Golf IV reported by the program "Plusminus" of German Broadcast ARD on Sept. 21, 98 at 9.35 p.m.;

XI. *failure of old pellets (gas pills) subjected to ageing, permeation of gas through the airbag-tissue resulting in allergy/suffocation/headache and environmental waste disposal thereof* whose airbags are installed in over 50 million vehicles per year;

XII. *sensor to retract (protract) seat belt* incapable of responding to any deceleration in yaw- and/or roll-related accident of AUDI A6 (A9), VW VR6 (B5) and Opel Astra B (A3 to A5, A8) due to the shortcoming ref. to case VIII and Chap. 1.3d to 1.3f;

XIII. *"oop"*[11] due to low stiffness of open section of all conventional seat rails whose large deflection, when subjected to great impact energy, changes the position of passenger to the deploying airbag which is then not able to fulfil its function properly;

XIV. *submarining*. By definition "submarining" of passenger in the event of front collision the passenger, having moved forward about w_V in Figs. 3, 4, 31 of DE 19749780 and thrown back against the back rest unit, submarines (slips downward) from his seat belt assembly whose members have been broken or come loose in excess of threshold value during the passenger's forward motion. In rear collision the passenger, thrown back against the back rest unit, does not activate the retractor mechanism, thus not removing the slack of his seat belt which permits the submarining verified by Ford's accident (B6);

XV. *intrusion of deformed vehicle side/door* of MB 190 (B3a), BMW 3 (B4b), BMW 7 (B3b), Opel Corsa (B3c) in the event of 100% side collision SK1 and of Toyota Carina (A13), MB C (A13) in EU-crash test, *of deformed vehicle roof of* VW VR6 (B5) and MB E320 (A3, A4, A7), *of power plant (drive assembly)* of Honda (B9), VW Golf III (B1), Peugeot (B8a) and MB S280 of al Fayed/Diana and/or *of steering column and wheel* of two Nissan Patrols (A14) in 40 % offset crash test. See A19, Chap. 1.2d and 1.2h;

XVI. *passenger ejection,* when doors detach themselves, in the event of arbitrary collision of BMW 5 (B4a), VW VR6 (B5), Ford (B6), Chrysler (B10a) fined $ 262.5 millions by a court in South Carolina;

XVII. *invalid limits legislated in obsolete specs* of SAE AS 8049 and JAR 25.561 to 25.785 in turbulence-related vibration of aeroplane. According to FAA the casualties of 863 minor, 63 severe injuries and two fatalities are reported in 252 incidents in USA between 1981 to 1996. On Canadian TLC Broadcast of 25 Nov. 97 Ron Schleede and Tom Haueter from NTSB reported severe/fatal injuries in turbulence-related incidents. Life-endangering lap belt allows the upper part of body to dangle around the seat. See my letters (C2, C3) with the same content to FAA/JAA, letters (C1) to NTSB and letters of Air Canada (C4), Swissair (C5) and Daimler Benz (C6) regarding my inventions. According to Dr. Wigger from Lufthansa turbulence-related incidents will progressively grow because of the increase of turbulences and traffic/flight congestion within a decade;

[9] AMS is an abbr. for Auto Motor und Sport.
[10] B letter confirms 100 % European Patent.

XVIII. *catapulting in arbitrary direction* due to lack of laws enforcing passenger restraint. 54 commuters were hurt by great kinetic energy of two colliding trains or commuters e.g. of a train speeding at 12 miles against an idle train in the railway station Toronto on Nov. 19, 97 ref. to Toronto Star of Nov. 19, 97. Greater kinetic energy in collision of car, train or aeroplane at faster speed imposes injuries on almost all **unrestrained** passengers, such as over hundred fatalities and over two hundred injuries in the ICE-train accident at the speed of 200 km/h on June. 3, 98. In other words, a car having life-threatening test results cannot protect restrained passengers from injuries in any real accident, especially those *unrestrained* from *heavier* injuries.

1.1 Failure of prior art

The above-mentioned cases justify questioning of the prior art of survival chance and R&D work for several decades such as front airbags for more than two decades, restraint systems for more than three decades, thereby allowing the prediction of a progressive increase of severe/fatal injuries by
- front airbags due to faster sensors whose operation is unreliable due to the huge number of calculations within a short time,
- side airbags due to a couple of R&D years and extremely short deployment time less than 5 ms (milliseconds) and;
- failure of prior art due to arbitrary collision and/or rollover.

Failure of prior art is attributed to the following assumptions for the ideal load case:
- let the *centre* of vehicle door be subjected to a *single* lateral load in arbitrary side collision;
- let the *centre* of vehicle be subjected to a *single* horizontal load in arbitrary front collision;
- let *free* connection be valid for form-locking connection etc.,

in order to obtain simple, inaccurate boundary conditions and formulate a FEM- model which is invalid for real loading case, even in a 50 % offset crash test of two similar MB E230s (A15, Chap. 1.3g) and in real collision of MB C, MB E320, MB S280 (case VIII) despite **innumerable** patents of Daimler Benz/ MB, Dasa, MBB, Temic and MB supplier TRW!
Ref. to Fraunhofer Magazine 4/97, Dr. Werner Riethmüller in co-operation with Bosch Corp. has invented a sensor capable of determining the signal of deceleration in x-, y- and/or z-direction, but incapable of determining the signal of yaw- and roll acceleration, thus limiting the applicability and leaving the yaw- and/or roll-related injurious problems (A19, Chap. 1.3a to 1.3i) and phenomenon (Chap. 1.3) unresolved. Moreover, years will pass away during the production into reliable 3-D sensors.
To what extent of danger, illness and environmental hazard should passengers of car equipped with six to eight airbags be exposed while the airbag-industry boosts production, profits and decreases deployment time at the risk of decapitating and false deployments?

1.2 Collapse of vehicle structure, intrusion and life-threatening test results

The applicability and superiority of all my inventions to the present patents of Daimler Benz/MB, Volvo, BMW, Porsche, VW/AUDI, Ford, GM/Opel, Dasa, TRW etc. are certified by Daimler Benz, Swissair, Air Canada, GDV, Deutscher Verkehrssicherheitsrat and examiners of German and European Patent Office, convinced by **novelty**, willing to grant patent thereon within 11 months. Definitely, my inventions represent tools to ensure and enhance survival chance in any real arbitrary collision and/or rollover, pile up[12] or in turbulence-related incident. Three car manufacturers, one of which has an esteemed reputation in survival chance, and two aeroplane manufacturers are investigating the use thereof.

Contrarily, the remaining manufacturers have refused to investigate by citing the tests, they passed, whose data are life-threatening (A12) such as femur-fracturing forces of over 1 tonne, rib-fracturing belt forces of over 800 kg etc. If compulsory, *one to three digit $ millions* are diverted from $ billion profits for *each recall program* of Mitsubishi, Honda, Mazda, VW/AUDI, GM/Opel/Saab, Renault, Fiat, MB, BMW/Rover[13] etc. serving as last resort to fix insufficient/erroneous R&D work at the expense of severe/fatal injuries? Because some car, e.g. Opel, owners were out of reach, approx. 123000 defective Opel Corsas (AMS 11/97) have not been rechecked/fixed. A 18-year old female driver[14] of one defective Opel Corsa was fatally injured due to non-deployment of the front airbag, the co-driver was severely injured despite the deployment of the other front airbag[15], thus **doubting** the reliability of front airbag (see **rate** in Chap. 1.3), and another passenger was severely injured too.

1.2a In the collision against barriers the impact energy of MB C was absorbed by the right, C-shaped energy-absorbing spring dome ref. to DE 4342759 C1[16], which is improved by my patent DE 19615985 C1, the belt retractors were, presumably, activated, but front airbags were *not* fired.

1.2b In the collision against a bridge-column and rollover the impact energy of AUDI A6 (A9), having test results nearly at the same level of MB C, was *partly* absorbed by energy-absorbing runners ref. to DE 4224489 A1, whose energy absorption is optimized by DE 19615985 C1 and DE 19636167 C1. Presumably, in excess of the limit of his seat belt associated with non-protraction thereof and non-deployment of his front airbag Dressler (A9) was thrown through the windshield. The *limited* applicability of DE 4224489 A1 is demonstrated by Figs. (B2) and the test results of AUDI A8 (A11, A12) exceeding of MB E320 (A11) by

204 % concerning seat-belt force, 132 % concerning HIC, 61 % concerning head deceleration, 40% concerning chest deceleration and 42% concerning pelvis deceleration.

Despite being positioned in the class of top luxury cars such as MB-S, BMW 7 etc. and the sale-price *twice* as expensive as Opel Omega, AUDI A8's test results are larger than Opel Omega's.

1.2c Due to limited applicable prior art the passenger compartment of VW VR6 (B5), VW Golf III (B1), MB E320 (A3, A4, A7), MB 190 (B3a), BMW 3 (B4b), BMW 7 (B3b), Opel Corsa (B3c) and/or runners of AUDI A8 (B2, A11) in state of total deformation is/are not able to absorb the *residual energy* imposed on passengers serving as energy-absorbing elements!

1.2d Owing to great stiffness of the ram front bumper and vehicle frame, sport-utility vehicle is capable of driving over potholes and bumps in forest, but incapable of absorbing/releasing energy in real accident, thus totally deforming any vehicle and **severely/fatally** injuring

- passengers of any vehicle arbitrarily rammed/crashed by the ram front bumper loaded with great impact energy thereof,
- pedestrians in accident related to skidding on-wet road, and/or
- its own passengers in real front collision against a stiffer barrier due to the intrusion of steering column, wheel, collapse of vehicle structure and to great remaining energy transmitted by the ram front bumper, girders and runners, substantiated by **fatal** test results, e.g. 1518 HIC and 1006 HIC of Nissan Patrols (A14), built in 1990 and 1994, *crashed at 50 km/h, substantially larger* than 229 HIC of MB E320 (A9) crashed at 55 km/h.

For the purpose of absorbing/releasing energy, the ram front bumper is mounted in front of at least one pair of independently operating piston devices equipped with spring elements and/or large-area deformable elements shown in Fig. 1, 2, 29 to 33 of 19615985 C1, whereby the great stiffness of the vehicle frame remains unchanged. For the purpose of optimizing the energy-

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[13] AMS 10/95, 6/95, 11/97, FAZ Oct. 11,97, Oct. 9.98, Wiesbadener Tagblatt of June 27, 95.

[14] investigation case of the prosecutor Steinbacher in Heidelberg. Approx. 123000 Opel Corsas having defective airbag-plugs are on roads/highways. Next severe/fatal injuries are expected!

[15] Crash test of Opel Corsa, Ford Fiesta and Fiat Punto conducted by TÜV results in failure of airbags ref. to Spiegel 13/95. The head of Opel Corsa's dummy/driver was thrown against the vehicle door.

absorption property of runners in Fig. 17 and 18 the release of power plant in Fig. 1 to 4, 19 of DE 19636167 C1 is recommended.

1.2e Femur-fracturing and rib-fracturing test results of brand-new vehicles Fiat Tipo (AMS 2/94) [17] and mutual Van FB (Peugeot, Citroen Evasion, Fiat Ulysse, Lancia Zeta) in Table 1 (A12) pose a great life-threat to passengers who are further exposed to the residual energy upon the collapse of vehicle structure of Peugeot (B8a), Ford Fiesta (B8b), Fiat Tipo, Honda (B9) etc. in any real accident at higher speed as a result of failure of prior art and insufficient R&D work.

1.2f Collapse of vehicle-side/door structure of Toyota Carina (A13), MB C (A13) in EU-crash test, substantiating severe/fatal injuries in real side collision, is resolved by form- and/or force-locking connection of adjustable clamping means ref. to EP 0869878 and/or pending patent DE 4342038 (not attached), spring elements ref. to DE 4342038 to cushion the impact and side deformable elements ref. to DE 19615985 C1.

1.2g Collapsing vehicle structure of Chevrolet Trans Sport/Opel Sintra is substantiated in a comparative IIHS test of nine vans (A16) and an AMS test (A17, A18). Los Angeles Times quipped "explosion of an empty beer can" on that vehicle structure. On the other hand the GM-Speaker Brian O'Neill found a common excuse for "one among 72 crash tests to the failure", hopefully, could repeat it, if he himself and his family members were involved in any real accident of this van at speed over 55 km/h. Despite the redesigning work the vehicle structure of Opel Sintra van was totally deformed in that AMS test (A17) just at 55 km/h. See the report of AMS 15/97 and Spiegel 42/98. Are these vans designed for driving at creeping speed on non-congested roads?
VV Polo built in 1994 is safer than all those vans, built later on, whose design must totally be overhauled, just like of MB A by a number of patented deformable elements and by displacement of power plant. However, the survival chance of MB-A in Fig. 2a, 3a of DE 19615985 C1 and Fig. 7 of DE 19636167 C1 is enormously improved by a compact car "GO", in Fig. 2, 3 in pp. 3/col. 40 to pp. 5/col. 13 of DE 19615985 C1 and in Fig. 1 to 4, 19 of DE 19636167 C1, serving as an ultra-light-weight car consuming less than 3 l/100 km.

1.2h Collapse of vehicle structure, intrusion of vehicle roof, door (case XV) and/or passenger ejection (case XVI) are due to door detachment in co-operation with failure of door locks. A thorough research thereon led to numerous inventions ref. to EP 0869878 and DE 4342038 of form- and/or force-locking connecting and **adjustable** clamping means arranged to the following compound pairs:
front vehicle door / rear vehicle door, vehicle door / vehicle roof, vehicle door / side rail, vehicle door / post section(s) and vehicle door / passenger compartment in order to

- interlock all compound pairs, thus defining a compound construction, increasing of structural stiffness, distributing impact energy on all compound pairs and **lowering stress** in arbitrary collision and/or rollover; and
- save costs owing to a **single** construction, manufacturing, testing expenditure, assembly and material supply to pass the EU- and US-Crash Tests, thus avoiding the use of incompatible patents.

Confronted with the court-verdict (case XVI) Chrysler has reinforced the present door locks but the problem of door detachment remains unresolved! See Requirement Nr 19.

Summary:

Due to failure of prior art and insufficient/erroneous R&D work resulting in collapse of vehicle structure, door detachment, insufficient energy absorption and failure of restraint system, airbag etc., millions of vehicles will post new record of physical/social/economical loss in real accident (Chap. 3).

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[17] Due the increase of femur force by 463 %, HIC by 91 %, pelvis acceleration by 38 % etc. in comparison with VW Golf IV, a mid-front collision against a truck on the road B260 ended up in instant fatal injury ref. to Wiesbadener

The **totally deformed** vehicle structure of van Chevrolet Trans Sport (A16), Opel Sintra (A17, A18), heavy sport-utility vehicle Nissan Patrol (A14) etc., having passed the EU- and US-Crash tests, bear evidences of reviewing/legislating all live-spacing requirements listed in Chap. 4.

1.3 Failure of three-point seat belt, airbag and whiplash-acceleration

Volvo's side airbag cushions the head by decreasing the chest acceleration about 14 %, but increasing the pelvis acceleration 4 % despite the absorption of side impact energy by five laterally-built reinforced elements at the time of energy transmission into the vehicle floor. Regarding the similar cars Volvo 850 provided with this embodiment ref. to EP 0565501 A1 in the side crash test according to FMVSS 214 at velocity increased by 17% reported by AMS 5/95 and in the front crash test reported by ADAC 5/95 the test results are listed in the following table:

Dummy as driver of Volvo 850	Test results *with* side airbag	Test results *without* side airbag	FMVSS 214	Test results *with* Front airbag
chest acceleration (m/s^2)	60.9	71.1	85	34.7
pelvis acceleration (m/s^2)	77.2	74.I4	130	33.4

Concerning the chest- and pelvis acceleration the test values of the side airbag, **two times** higher than those of the front airbag, must be considered as very alarming. Of the same magnitude, the *lateral* acceleration of vehicle laterally crashed by another vehicle inflicts more severe injuries on occupants than *longitudinal* acceleration of vehicle longitudinally crashed by another vehicle because head, neck- and vertebrae-muscles are, hypothetically, the weakest members of the human being. Due to great energy in a side or double-side collision passengers are subjected to **physical limits** such as

- intrusion of one/both vehicle side(s) totally deformed (case XV);
- false deployment of side-airbags resulted from to extremely short deployment time, less than 5 ms according to the latest specification reported by AMS 12/96 pp. 50 due to lack of crumpling zone to absorb front energy; and/or
- insufficient decrease of chest acceleration and increase of pelvis acceleration resulted from small volume **solely** cushioning the head.

A plurality of side-airbags is costly and prone to more false deployments, thus provoking danger of an accident. The **rate of killing to saving lives** by front airbags at approx. 1 to 10, based on the estimation[18], non-deployed airbags of BMW 5, VW VR6, MB C, Opel Astra B, AUDI A6, fatal-deployed airbags of MB E320, VW Jetta, false-deployed airbag of Volvo and life-threatening test results e.g. of Opel Corsa, Ford Fiesta and Fiat Punto (Chap. 1.2, Spiegel 13/95, footnote 15), would become **worse** by side airbags due to cases I to III, V, VIII to X, XV, Chap. 1.3a to 1.3g and those physical limits.

To determine the causation of the highest rate concerning the number of fatal injuries in real side collision, studies of accidents were conducted by experts of GDV (A19). They discovered:

> "Two-thirds of all accidents at speed ranging from 60 to 130 km/h, wherefrom 5 % of accidents attributed to higher speed are excluded, on country and state roads in the '90s bear **resemblance** to each other. A car "X" skidding in the opposite lane is crashed at the vehicle side "XR" of its co-driver by another car "Y" coming in the opposite direction, thus resulting, **mostly,** in fatal injury of its restrained driver "No-hope" seated/arranged to the *non-crashed* vehicle side"..

[18] Ref. to Customer Reports 4/97 front airbags, credited with saving 1700 lives between 1986 and 1996, killed 36

The **phenomenon** regarding death of Opal's co-driver (case VII), whereof Dr. Löhne tried in vain to explain, and the above-mentioned drivers "No-hope", all of them seated to the ***non-crashed*** vehicle side and the **failure** of the /-shaped-restraining upper part of body by three point-seat belt are subject to analyse in compliance with Technical Mechanics/FEM.:

1.3a By definition a **whiplash-acceleration** is a longitudinal, yaw- or roll acceleration whose direction is *reversed* in ms, probably in a fraction of ms, at least one time in the event of arbitrary collision and/or rollover or in turbulence-related incident. The unrestrained head is further exposed to the whiplash-acceleration in reversing direction and upper part of body of a passenger to a forced undamped vibration in reversing direction till the energy is dissipated.

1.3b In weight-incompatible collision (A2, A19, C7)[19], a light-weight car e.g. Opel Corsa moving forward to a mutual collision point, is thrown back *in reversing longitudinal direction* by a heavy-weight car e.g. MB S300 for 5 m and rotated about its vertical axis at yaw angle 135°. Contrarily, the passengers of MB S300 are far less loaded by longitudinal and yaw acceleration..

1.3c. In the study[20] of rear collision a number of sled tests conducted by GDV and University Graz, Austria, one of 22 volunteers suffered from minor cervical distortion for two days, some from minor pains for one to two days due to whiplash-acceleration *in reversing longitudinal direction* despite low speed of 8.5 km/h and acceleration of 2.5 g.

1.3d Due to yaw-acceleration side/front airbag, retractor mechanism and/or belt pre-tensioner/tensioner cannot be activated (case VII), thus yaw-accelerating the unrestrained right shoulder of loosely restrained upper part of body of the "restrained" driver "No-hope", loaded by great energy, out of the /-shaped shoulder belt *in anti-clockwise direction.* When the vehicle side "XR" is crashed by the car "Y", his head is subjected to whiplash-acceleration and later on his upper part is rotated back *in clockwise direction,* his head/ upper part is/are smashed against the B-post section (pillar) and/or window pane. His head is further exposed to the whiplash-acceleration in *reversing yaw direction* and upper part of body "No-hope" to a forced undamped vibration *in reversing yaw direction* till the energy is dissipated.

Failure of survival chance in real side/front accident is attributed to **incapability** of

- the stiff passenger cell to absorb energy in lateral direction, thus transmitting energy to driver/passengers. This failure contradicts the common opinion to save life by arranging a seat for a single driver/passenger in the centre-line of vehicle. See countermeasures in Chap. 1.2h, 2a to 2c;
- sensors to sense yaw- and/or roll acceleration in association with non-/false deployment of side/front airbags. A plurality of smart, expensive side/front airbags is by no means live-saving, and/or
- three point-seat belt to properly restrain the upper part of body, thus allowing ejection of passengers of BMW 5 (B4a), VW VR6 (B5) and Dressler through the windshield of AUDI A6 (A9, Chap. 1.2b and 3) at speed of 120 km/h on highway. Not a speed limit of 130 km/h on roads and highways, but countermeasures described in Chap. 3.1 can solve this problem.

1.3e Due to yaw-acceleration of VW Golf II (B7) *in clockwise direction* the head/upper body of a young female driver "No-hope" is/are yaw-accelerated and crashed against the B-post section and/or window pane, when her vehicle side "XL" collided against a VW Passat coming in the opposite direction, then rotated back *in anti-clockwise direction,* thus being exposed to whiplash-acceleration, a forced undamped vibration in *reversing yaw direction* and fatality. A young male passenger "Few-hope", seated to the *non-crashed* vehicle side and through being clamped in a deformed vehicle part, is severely injured.

1.3f In a NCAP test (A10) a VW Golf IV is rotated at yaw angle 80° *in anti-clockwise direction,* thus throwing the head of dummy out of the open window (pp. 87 of AMS 23/97) and substantiating the death of that female driver "No-hope". In another NCAP test of Opel Astra B the head of dummy is crashed against the B-post section (pp. 52 of AMS 11/98).

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[19] See my letter (C7) to Brian O'Neill, President of IIHS and concern (A19) of Prof. Klaus Langwieder, Head of GDV

1.3g Due to limited applicable prior art two similar MB E230s with/without airbags (A8, A15, A9), 50 % offset crashing against each other ref. to AMS 19/91, rotate about the vertical axis of the mutual point of collision at yaw angle 40^0 *in anti-clockwise direction*, whilst transmitting great impact energy to deform both front sections of vehicle structure, dummies *in place of passengers*, passenger- and trunk compartments and both lid-locks thereby opening their lids.

1.3h In 50 % offset crash test conducted by AMS, any vehicle, crashed against a stiff barrier having a plain surface, is always rotated at yaw angle, listed in Table 2 (A12), *in anti-clockwise direction.*

1.3i In a turbulence-related incident e.g. of a Boeing 747 having larger payload of 356 tonnes and higher cruising speed of over 900 km/h, which are not specified in SAE AS 8049 legislated **July 1990** and JAR 25 legislated **March 1993**, thus resulting in 110 minor/severe injuries and one fatal injury due to the 300 m height-loss of that Boeing 747 of United Airlines en route from Tokyo to Hawaii in a single turbulence-related incident! Aviation payload-engineers and experts from NTSB, FAA and JAA, convinced by the protective function of lap belt, should study

- the history of fatalities from the '50s to the early '70s by lap belt allowing the upper part of body and head to severely/fatally crash against any stiff vehicle part,
- Bohlin's invention "three-point safety belt" to distribute energy to the upper and lower part of body, hence replacing lap belt. Despite the continuous improvement of three-point safety belt, recently, severe and fatal injuries have been accumulating due to increasing engine performance, reckless driving and the problem cases outlined in DE 19749780;
- HIC depending solely on the longitudinal acceleration of a dummy lap-belted to a seat *rail-guided* in a sled test conducted by TÜV (German Safety Board) in Cologne. Such test results are absolutely useless because aeroplane is **not** *rail-guided* in turbulence-related incident and the kinetic energy is much greater due to *larger* payload and *higher* cruising speed. What is the use of having a "passing" certificate invalid for survival chance in turbulence-related incident and landing crash?;
- physical/social/financial loss ref. to Chap. 3 resulted from reluctance to review those values;
- additional costs, just a fraction of the above-mentioned loss, to enhance survival chance ref. to Chap. 3.1;
- the confirmation of Carriers noted in Requirement Nr 21 to review; and
- the life-threatening threshold values of obsolete SAE AS 8049 and JAR 25, thoroughly explained in my letters, three of which (C1 to C3) are attached, to NTSB, FAA and JAA, thus resulting in severe/fatal injuries in turbulence-related incident and landing crash.

Nobody wishes to be the next victim. ***Responsibility for the safety of passengers is a matter of conscience.***

A head, shown in Fig. (A10a) and Fig. 3 of DE 19749780, in real accident or in turbulence-related incident underlies a total-acceleration dependent stress S_T obtained from the following equation :

$$S_T = \sqrt{(D_{x,y,z} + M_{x,y,z})^2 + 3 * T^2}$$

where $D_{x,y,z}$ = compression stress depending on acceleration in x-, y- and z-direction,
T = torsion depending on yaw acceleration Ö about z-axis and
$M_{x,y,z}$ = bending stress depending roll on acceleration Ü about x-, y- and z-axis.

The present limit of 1000 HIC in one direction, specified in EU-, US-Crash tests, SAE AS 8049 and JAR 25.561 to 25.785, is exceeded by any **total-acceleration dependent HIC**

- in a total crash test comprising front-, side-, rear collision test and rollover test;
- in a real accident of vehicle, train or aeroplane due to higher speed and larger load; or
- in a landing crash of aeroplane e.g. of Boeing 747 having a payload of 356 tonnes and an initial landing speed of 235 km/h.

See countermeasures in Chap. 3.1.

Why are **neither** specs concerning yaw- and roll acceleration and **nor much lower HIC** legislated in EU-, US-crash tests, SAE AS 8049 and JAR 25.561 to 25.785 despite my submittal of more than four attached registered letters (C1 to C3, C8) and of patent docs/appls to NHSTA; NTSB, FAA and JAA? On the TLC Broadcast (case XVII) Ron Schleede, Tom Hauter from NTSB and Ricardo Martinez MD from NHSTA had **plenty** time to detail severe/fatal injuries to each turbulence-related incident or real accident, but **no** time to evaluate the countermeasures explained in my docs. and acknowledge of receiving. Nevertheless, their lengthy description has helped me to develop countermeasures described in my coming 14th and 15th patent application.

1.4 An at least two-stage crash test to idealize a total crash test

The stiffness of the energy-absorbing vehicle structure comprising deformable elements, runners, panels, girders, airbags, restraint systems etc. in the state of great or total deformation at 55 km/h is far less than in the non-deformed state. See case III, Chap. 1.2b to 1.2h.
New crashing machine must be designed and purchased to perform a total crash test. In order to save expenditures and time, a total crash test is idealized by an at least two-stage crash test consisting of front-, side-, rear collision and rollover. A vehicle structure or aeroplane seat, already-deformed in the first-stage crash test, is able to ensure real survival chance, if the injury-related threshold values are not exceeded in the next-stage crash test in succession.

2. Countermeasures

All the aforementioned shortcomings and deficiencies are resolved by 13 patents, my 14th is in preparation, wherein *all load cases and boundary conditions in arbitrary collision and rollover are taken into account*, see e.g. page 3 to 4 of EP 0869878 and/or DE 4342038 resolving door detachment, intrusion, passenger ejection and increasing structural stiffness etc. For better understanding, the measures against the intrusion of power plant, collapse of vehicle structure and door detachment is summarized in the enclosure B1 in German and English.

2a In acknowledgement of the aforementioned problems of airbags, a dual use of front airbag in front and/or side collision and prolongation of deployment time to inflate front airbag have been invented and described in pp. 6 to 8 and claims 26 to 30 of EP 0844939 B1, for the purpose of benefiting the front passengers by further evaluating the vehicle destined for scrap, but at the displeasure of airbag-industry. In arbitrary side collision or double-side collision EP 0844939 B1 absorbs/releases great energy and removes the occupant from the injury-prone areas to the vehicle-centre by means of a rotatable device. A lateral energy-absorbing crumpling zone is defined by EP 0844939 B1, EP 0869878, DE 19615985 C1 and/or DE 4342038 in order to lower accelerations and forces in side collision to the level in front collision.

2b In acknowledgement of the aforementioned problems in offset front and/or rear collision, a pair of independently operating piston devices deforming the respective deformable elements, damping oscillation, pre-tensioning seat belts etc. is invented without sensors and pellets and described in DE 19615985 C1, DE 19636167 C1 and DE 19711392 C1. The additional weight of piston devices is compensated by a plurality of measures to downsize runners, side rails and vehicle girders, optimize the energy-absorption property of runners and enhance survival chance.

2c Great impact energy in arbitrary collision is absorbed/ released by the increase of energy-absorbing large-area deformable elements ref. to DE 19615985 C1 and energy-absorbing deformable runners ref. to DE 19636167 C1 which releases power plant in arbitrary front collision.

In arbitrary front and/or rear collision DE 19711392 C1, improving the renown safety device "procon-ten ©" of AUDI, pre-tensions seat belts within short time to resolve the case XIII *"oop"*, damps vibration, lowers acceleration and preserves pre-tensioning force of seat belts after fracturing the sites of predetermined fracture, pulls steering wheel from the area of the forward-moving head of the driver until fracture of said sites of predetermined fracture occurs and protects passengers in the event of failure of front airbags and sensors.
German Patent Office requested amendment of claims, which is already filed therein, for granting a patent on my invention of closed, round seat rails having the greatest stiffness among all profiles to solve the case XIII *"oop"* and cut production costs. Incorporation with round seat rails, seat mechanisms with/without memory to adjust in longitudinal direction and/or tilt are invented.
DE 19711392 C1, EP 0844939 B1 and DE 19749780, summarized in Chap. 3.1, are the first inventions of *damping oscillation by friction* in order to

- solve the cases I to VI and
- cushion impact while releasing energy which is demonstrated by Opel Astra B (A3 to A5, A8), intercepted by the central barrier in the event of skidding on a wet highway, whose energy was slowly decreased by the work of *friction* along that barrier, thus lowering the injury-severity level. In a common accident (A7, A9, B4a, B5), this driver would be severely/fatally injured.

3. Physical, social and financial loss

According to Prof. Langwieder (A19, FAZ of Oct. 13,98) the costs to treat concussion are estimated at DM 4000, however heel-bone fracture at DM 200000 plus economical burden due to the long-term hospitalization, rehabilitation and loss of earnings. Newspapers world-wide reported the extensive, hence, expensive treatment of the renown SPD-politican Dressler whose work ability, I assume, has been impaired by the accident (Preface, Chap. 1.2b, A9). Insurance does not cover loss of performance/abilities/earnings of injured passengers. The report[21] of GDV and NHSTA in pp. 72 to 73 word by word

> "Acute and chronic symptoms sometimes persist for years and to many cases, where there is no obvious early incapacitation, the effects of the accident may not surface until months later"

supports the thesis of *incalculable, physical/social/economical loss,* resulted from severely-injured persons and their family members, in case of cervical trauma, quadriplegia and on-going treatment, consisting of costs

1. for *short- and long-term treatment,* estimated at $ 10 billions to treat only cervical distortion/trauma per year according to O'Neill's Report[22], and
2. for *emotional treatment.* Relief funds of DM 32 millions, provided by the Interior Ministry of State Rheinland-Pfalz, have already been spent in a decade-long emotional treatment of just a hundred victims, whose medical treatments are being covered by insurance, due to the aeroplane crash on the US-base in Ramstein at Aviation Show on Aug. 28, 88 (Wiesbadener Tagblatt of July 30, 98). More funds for long-term emotional treatment are on request.

According to the EU-Report[23] the annual road toll of 45000 fatalities and 1.6 million injuries costs DM 290 billions plus *incalculable loss*, which, totally, are, presumably, lower than the total loss for the US and Canadian annual road toll. Additional $ billion loss per year is due to injuries in road-rage related accidents, turbulence-related incidents, landing crashes of aeroplane and accidents of train.

[21] "Comparative Studies of Neck Injuries of Car Occupants in Frontal Collisions in USA and Germany", 25th Stapp Car Crash Conference.
[22] "Whiplash Injuries", Status Report IIHS, Sept. 95

Very cheap traffic signs, posted along the road/highway Tokyo to Fuji, reminding drivers to carefully drive are by no means life-saving as long as millions of cars (A13, A14, B9 etc.) are equipped with vehicle structures/parts collapsing and/or intruding in real accidents at speed over 50 km/h. The Japanese Ministry of Health/Transport should list the annual road toll and costs.
Expensive R&D work of MB as well as Volvo mostly saves life, costs and budget of taxpayers and states. However, severe/fatal injuries in real accident of the world-wide safest cars Volvo, MB 190, MB E320 and MB S280 of al Fayed/Diana substantiate the insufficiency of survival chance, wrong approach, false boundary conditions and the need to improve that prior art by formulating more accurate boundary conditions in arbitrary accident/pile up or in turbulence-related incident.
Would taxpayers and/or states be burdened by additional costs to treat severe/fatal injuries in the event of real accident of Italian (Fiat), French (Renault[24], Peugeot[25]), Japanese (Toyota, Nissan, Honda etc.), Korean[26] and Malaysian cars, characterized with larger life-threatening data, flooding EU- and/or US-market in order to achieve **big profits** by neglecting R&D work?

3.1 Additional costs to enhance survival chance

Let us focus on the inventions of DE 19749780, subdivided into three patent appls. in order to be granted as patents, concerning a safety restraint system, equipped with an energy-absorbing method, integrated in a seat serving as "A seat-integrated restraint system" to

- X-shaped restrain the upper part of body by crossing both shoulder belts and gradually absorb/release great energy in order to control all acceleration rates and loads below the respective injury-related threshold values during the arbitrary real collision and/or rollover or turbulence-related incident, thus ensuring passenger restraint and saving life;
- manually or automatically operate a pair of energy-absorbing shoulder-shaped caps and/or an energy-absorbing neck brace in exceed of speed/acceleration, in real accident of vehicle, train or aeroplane or in turbulence-related incident;
- damp oscillation as well as whiplash-acceleration;
- increase the use of restraint system by an user-friendly belt-feeding device, operating the restraint system from three-point to multi-point attachment and/or activating the restraint system manually or automatically: The **principle criterion** for user-friendliness to encourage the use thereof is confirmed by Daimler Benz (C6). The present multi-point restraint systems and prior art are neither user- friendly nor time-efficient, thus discouraging the use thereof;
- use the parts of the vehicular, conventional restraint systems for the purpose of saving R&D expenditures, time and increasing the reliability;
- extend the use of any three-point seat belt by inserting an inventive upper shoulder belt of belt protracted from a belt reel fastened in the back rest unit for the purpose of lowering the injury-severity level and the number of injuries in arbitrary real collision during the transition time to manufacture and test a brand-new extra-long belt. The extra costs for both belt parts are low.

See the Chap. "Advantages..." and problem cases mentioned in DE 19749780.
The market/street prices of three, conventional restraint systems of Opal's front seats are listed in the following table

	Seat belt	Belt protractor
Opel Omega	DM 205	DM 260
Opel Vectra	195	250
Opel Astra	189	253

[24] Photos of Renault Twingo showing the large intrusion of a totally deformed door are in my possession.
[25] Minor/severe/fatal injuries in a collision of a Peugeot 306 against a kerbstone resulting in a rollover in Mainz and in a front collision of another Peugeot 306 against a car outside of Bad Schwalbach are reported by Wiesbadener Tagblatt of July 13, 98 and Oct. 02, 98.
[26] 40 % offset crash test of Hyundai Accent, Daewoo Nexia and Kia Sephia at speed 50 km/h conducted by ADAC

Sales prices of supplier usually range from 10 to 20 % of market prices, at an average of DM 70 plus licencing fees and manufacturing costs for user-friendly belt-feeding devices and/or shoulder-shaped caps and/or neck braces.

Additional costs to enhance survival chance of

- a vehicle are the amount from the multiplication of the number of seats by the licencing fees and manufacturing costs;
- an aeroplane are totally DM 3 to 60000 from the multiplication of the number of seats, say 300, by sales prices, say DM 1 to 200, **far less than the costs of short- and long-term treatment for 111** minor/severe/fatal injuries in a single turbulence-related incident ref. to Chap. 1.3i and 3. Optionally, seats in business- and/or first class are equipped with belt-feeding devices;
- all vehicles are a total amount far less than three-digit $ billion loss world-wide per year owing to lowering injury-severity level, particularly, in association with the implementation of other countermeasures of 12 patents, thus minimizing the costs from DM 2 to 400000 for the highest injury-severity level to DM 3 to 4000 for minor injury or zero for no-injury; and
- a train are the amount from the multiplication of the number of seats by sales prices.

Additional costs to prolong deployment time, increase reliability, survival chance in side/front collision (Chap. 1.3a to 1.3h) and save environment etc. by inventions of EP 0844939 B1 (Chap. 2a) "Side airbag-substitute of seat for any vehicle" are a **fraction** of a pair of side airbags:
In relation to the price tag of DM 4339 for a pair of Mercedes' front airbags and of the average DM 3500 of other car manufacturers (AMS 7/95) the price tag of DM 748 for a pair of Mercedes E's side airbags with 15 litres is really a **"gift"**. If a side airbag having a deployment time of 5 ms and the test data as low as that of front airbag could be marketed, the sales price would, beyond doubt, be **extremely higher**. For assembling the most expensive substitute B3 from a shock absorber, a coil spring (sales price of DM 10 to 12) an overall cost of DM 260 is calculated. Dramatically lower are the manufacturing costs for the substitute B5 comprising a leaf spring (sales price of DM 3 to 4) to protect **driver and co-driver** and/or a torsion spring consisting of flat strips (sales price of DM 1 to 2). For safety reasons in the automotive industry suspension systems must always be designed to satisfy a great number of tough requirements which are not needed for the substitutes, thus enormously cutting manufacturing costs. The deployment of front airbag of vehicle destined for scrap within few milliseconds in side/front collision costs a few bucks.

4. Life-saving requirements for EU- and US-crash tests

1. review/legislate non-injurious threshold value of longitudinal, lateral, vertical, yaw-, roll acceleration, total-acceleration dependent HIC, belt- and femur force;
2. legislate specs of an at least two-stage crash test consisting of front-, side-, rear crash test and rollover test;
3. review/legislate specs of an angular front crash test to lower the highest rate of fatal/severe injuries in FK3 and FK4 (A1). Evidently, sensors are out of function in front crash at $\alpha > 30^0$;
4. review/legislate specs of an angular side crash test to lower the highest rate of fatal/severe injuries in SK2 and SK3 (A1). Evidently, sensors are out of function in side crash at $\beta > 30^0$;
5. review/legislate the specs of a rear crash test to lower the highest rate of fatal/severe injuries in HK1 and HK2 (A1) and to prevent submarining;
6. legislate a percentage of max. cruising speed to define a higher test speed. Any concern of car manufacturer is in contradiction to a $ billion investment in R&D to produce a ultra-luxury car[27] equipped with a "*555 HP, 6.3 litre and 18 cylinder*" engine despite world-wide traffic congestion while neglecting the R&D to improve survival chance;

7. legislate specs of a great energy-absorption and soft-cushioning property of heavy-weight car and sport-utility vehicle;
8. legislate specs of a ram front bumper of sport-utility vehicle to absorb energy, thus saving life of pedestrians and passengers of a light-weight car arbitrarily crashed thereby;
9. renew specs, met by the design of brand-new BMW 5 (B4a), brand-new VW VR6 (B5) and Chrysler, to prevent door detachment (case XVI);
10. legislate specs to release a power plant in arbitrary front collision at speed, say, over 60 km/h to prevent intrusion (case XV);
11. legislate a minimum distance of a passenger/seat to a door/window pane deformed in arbitrary side collision;
12. legislate a minimum distance of a head to a roof deformed in rollover;
13. legislate threshold values of forces and accelerations when front airbag and/or side airbag fails;
14. legislate a minimum distance of a steering wheel to a head/body of the driver and threshold value of accelerations and forces of parts of his body when his front airbag, seat belt, retractor mechanism and/or belt pre-tensioner fail;
15. legislate an allowance for the deflection of seat rails to avoid "oop" in arbitrary front and rear collision;
16. legislate specs to ensure the function of sensor/pellets/airbag, e.g. failure rate 1 to one million. See the rate of killing to saving lives in Chap. 1.3;
17. legislate specs to waste-disposal of pellets in compliance with environment;
18. lower/legislate specs to substantially lower explosive loudness of front-, side airbag and to total explosive loudness of all airbags installed in a car. The permissible EU-sound level at **140 dB** is enormously louder than the sound level of a compressed-air hammer
    - in outdoor at 1 meter distance at **93 dB** or
    - in a room having a sound-energy-absorbing property of 10 m^2 at **103 dB**.

    By definition, sound level L [dB] is equal to 10 log (J_1/J_0), where J_1 and J_0 [W/cm^2] are sound intensities;
19. legislate laws to levy heavy tax/ premium on life-threatening vehicles, thus financing the short- and long-term treatment for injuries and forcing car manufacturers to invest in R&D. Only the $ 262.5 million fine (case XVI) led Chrysler Corp. to the decision to invest in reinforcing door locks which cannot avoid door detachment/passenger ejection (case XVI, Chap 1.2h). How can a reinforced lock pawl resist to great energy? Next passenger-ejection and sue/fine will occur;
20. legislate laws to enforce the use of seat belts of vehicle, train and aeroplane; and
21. renew/legislate specs of SAE AS 8049 and JAR 25.561 to 25.785, wherefor Chown from Air Canada (C4), Schmid from Swissair (C5) and Dr Wigger from Lufthansa have confirmed the need.

5. Enclosures

A1 to A19 incl. three accident reports of Highway Police Dept. concerning MB E320, MB C and Opel Astra B
B1 to B12
C1 to C8

Six of 13 Patents in English are *exceptionally* attached:

EP 0844939 B1 (CA 2,230,721, US..)
EP 0869878 (CA 2,220,872, US 08/860,182)
DE 19615985 C1 (US..., CA...filed by the end of Sept.)
DE 19636167 C1 (CA 2,236,816, US already filed 19.04.98)
DE 19711392 C1 (US..., CA...planned to file by the end of Oct.)
DE 19749780

 GDV A1

Münich.

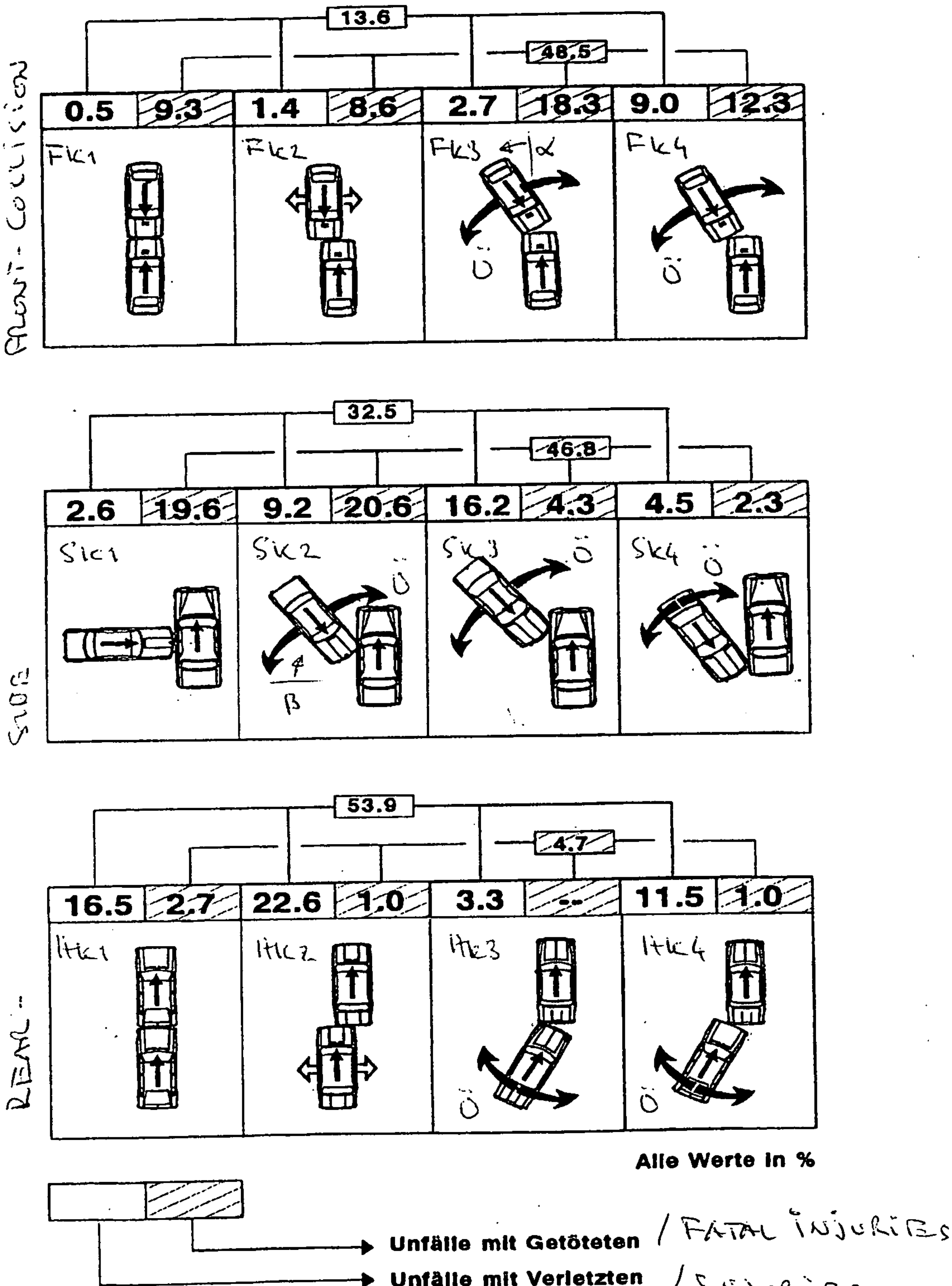


Bild 36: *Verteilung der Unfälle mit Verletzten und Getöteten nach Kollisionstypen (100% = alle Verletzten/Getöteten) bei Pkw/Pkw-Unfällen in den alten Bundesländern*

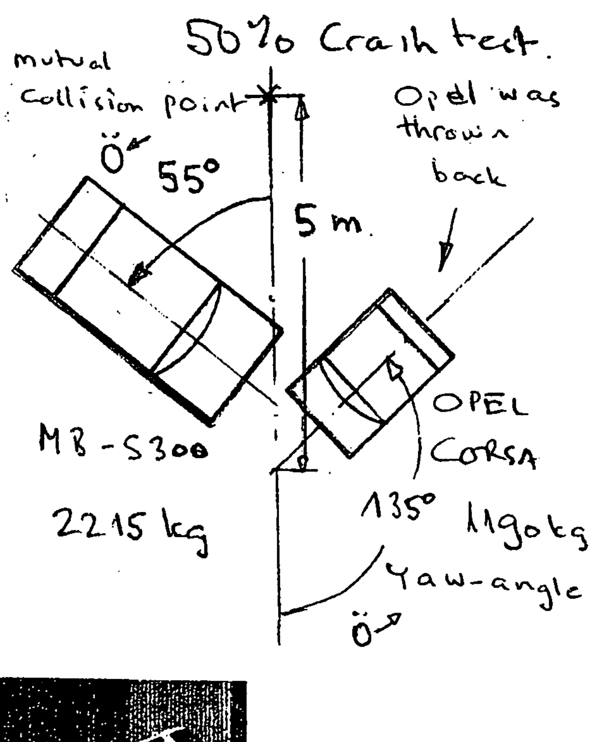
ML

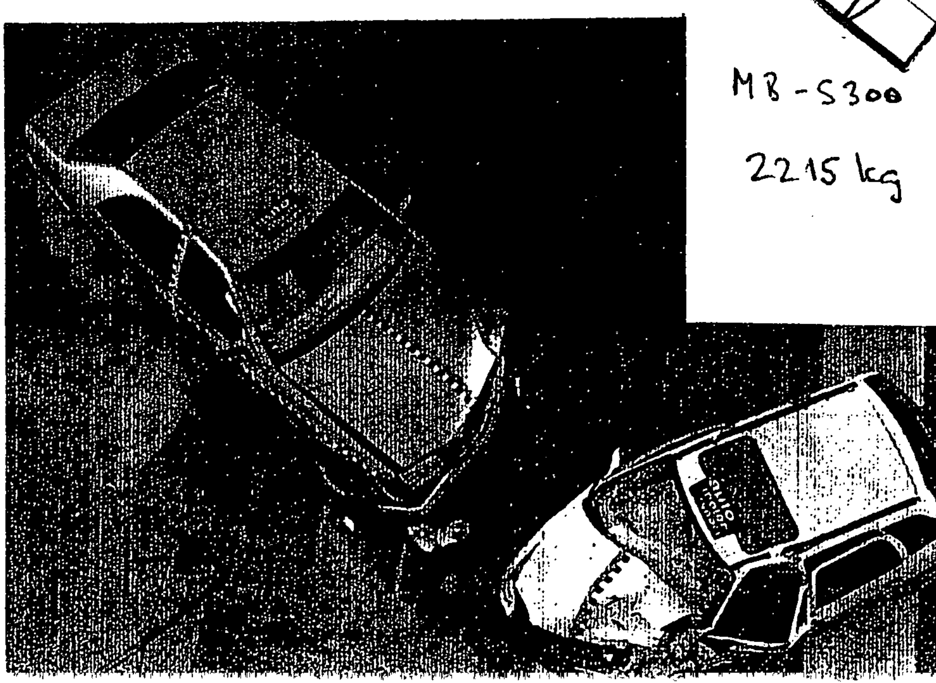
Die Impulsdominanz des Mercedes führt beim Opel zu einer Bewegungsumkehr und einer starken Drehung

FOTOS: H.D. SEUFERTT, H.P. SEUFERT

Mercedes S-Klasse und Opel Corsa treffen mit jeweils 50 km/h aufeinander, der Vorbau des Mercedes bohrt sich in den Opel

reverse-acceleration causing strong whiplash and yaw acceleration Ö. In weight-incompatible collision (A2), a light-weight car e.g. Opel Corsa moved forward to a mutual collision point, was thrown back by a heavy-weight car e.g. MB S300 for 5 m and rotated about its vertical axis at yaw angle 135^0. Contrarily, the passengers of MB S300 are far less loaded by longitudinal and yaw acceleration. The countermeasures of DE 19636167 C1 release power plant, optimize the energy-absorption property of runners and of DE 19615985 C1 absorb more great energy.





Endlage: Der Opel Corsa bleibt um 135 Grad verdreht liegen, der Mercedes dreht sich um 55 Grad

AMS 4/95

A3

Instant death, cervical distortion and concussion due to non- or false deployment of front airbags associated with non- or wrong evaluation of yaw- and/or roll acceleration

Vehicle	FOA	FMBC	FMBE
registered	13.05.98	06.05.97	08.93
accident day	14.09.98	02.09.98	02.02.97
police-accident report	enclosed	enclosed	enclosed
vehicle ident. number	WOLOTGF35W2 145584	WDB2020181F603682	
buckle assembly	Autoliv 3722B 90566055	MB 20886003 69 560 2671 02A 167	
latch plate		Meets FMVSS 209 ADR4 202 860 9588	
driver	FOA1, 30-year old, CD*	FMBC1, 45-year old	FMBE1, 47-year old
co-driver			FMBE2, 41-year old
airbag	**non-deployed**	**non-deployed**	**falsely deployed**
evidence for failure	photo	photo	photo

FOA: abbr. for Opel Astra B; 1.6 l; K 55 (75 Hp)
FMBC abbr. for MB C; 1.8 l
FMBE abbr. for MB E320; 220 Hp
CD* abbr. for Cervical distortion
Owing to the ages the accident-involved passengers were, taken as given, healthy

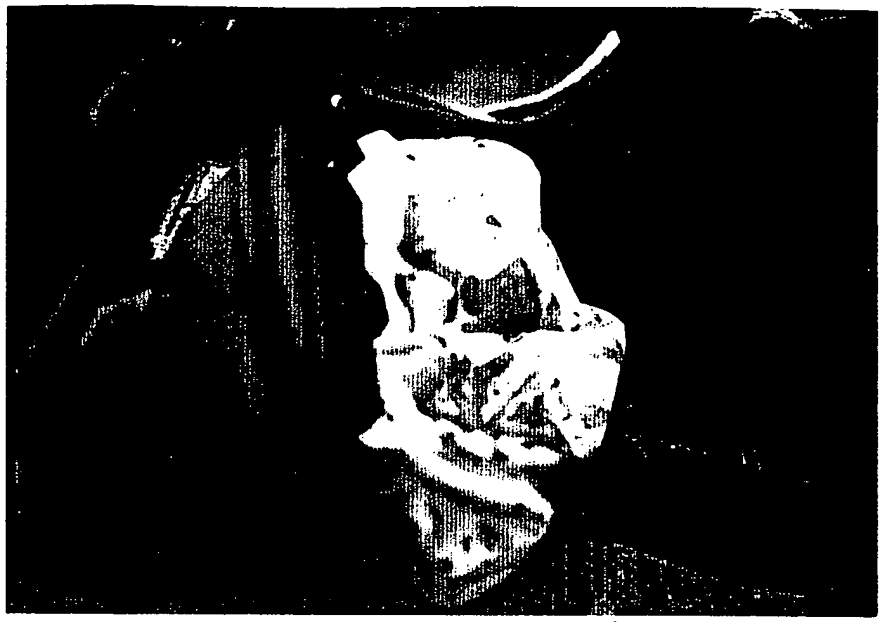
<u>FOA1</u>
On a casual meeting at the automotive salvage service "Baumann" on 15.09.98, Dieter Kraiker (+4969 78071744), the boss of FOA1, disclosed that FOA1 has admitted a concussion after being discharged from the hospital, Real injury severity usually surfaces after several days elapse..
Opels supplier is Autoliv/Autoflug in Elmshorn..
Note: Opel Astra B has passed the latest NCAP test.

<u>FMBC1</u>
Despite the large femur-force at the same level of AUDI A6 and the high speed of 150 km/h on a wet highway ending up with skidding, FMBC1 was not injured, in contrary to Rudolf Dressler, driver of AUDI A6 in the accident. Apparently, impact energy was dissipated by the C-shaped energy-absorbing spring dome of MB C ref. to DE 4342759 C1.
MBs supplier is TRW/Repa in Alsdorf.

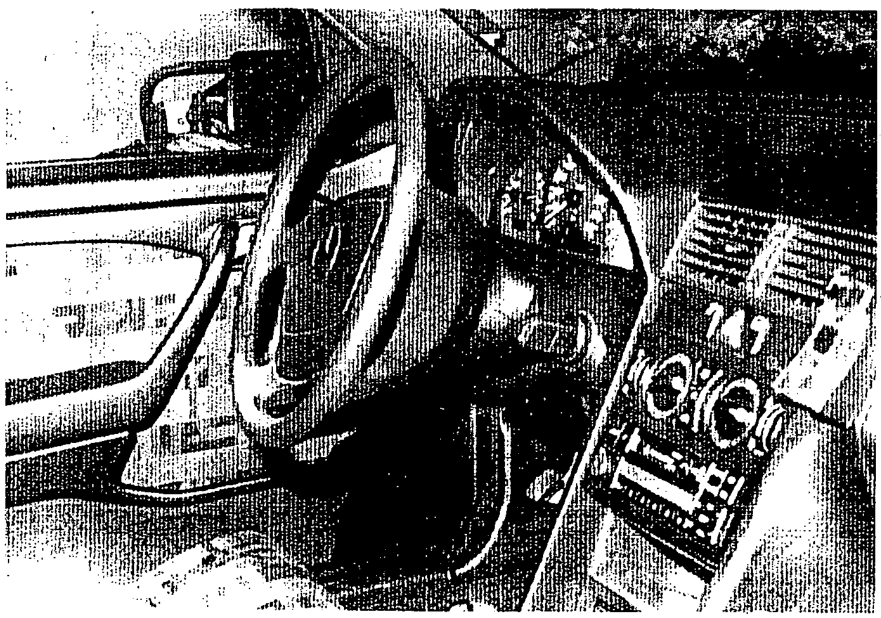
<u>FMBE1 and FMBE2</u>
Which key factors, responsible for fatal injuries of both passengers, cannot be determined. However, both front airbags stained (soaked) with blood were the result of bombing out their heads. See photo of the blood stained front airbag of driver.
Thanks to the lowest test data MB E320 is the safest car among the cars, with the exception of Volvo, crashed by Auto Motor und Sport.

Wiesbadener Kurier of 29.11.96 reported another failure of front airbag beheading a baby in the event of *rear collision* of a VW Jetta *rearwards driven* at the parking lot in the US-state Idaho.

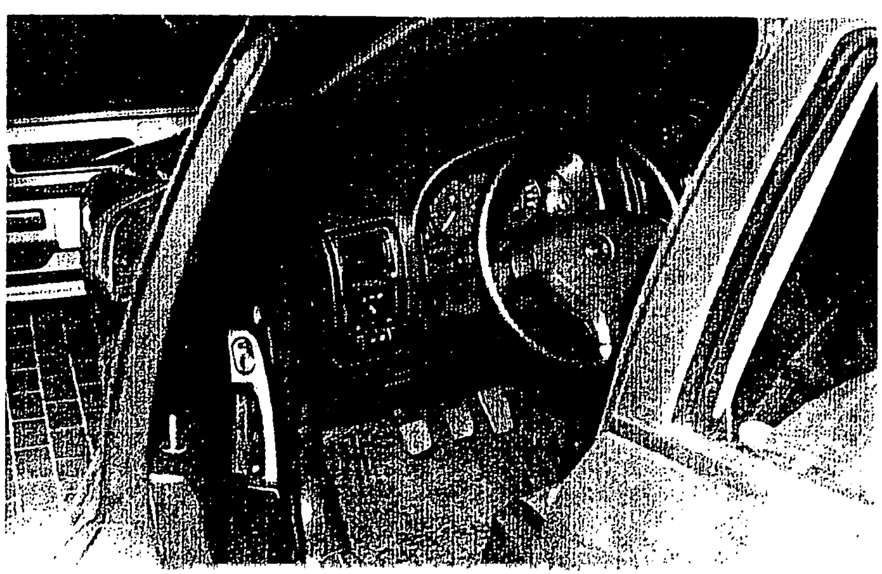
blood-stained, falsely deployed front airbag of MB E320



non-deployed front airbag of MB C



non-deployed front airbag of Opel Astra B



Polizeiautobahnstation
Wiesbadener Str. 74
65510 Idstein/Ts.

Tgb. Nr.:

Reg.Präs.Kassel

Ordnungswidrigkeit verjährt am:

Naß 21^50 Uhr
14.09.98

Tatbestands- X
Protokollaufnahme
RB Krs Gem 533003

Behördenkennung (Dienststellen-Nr.): 34
Unfalldatum (Tag/Monat/Jahr): 140998
Unfallzeit (h/min): 2150

Anzahl der Beteiligten	Getötete	Schwerverletzte	Leichtverletzte	Gesamtsachschaden (volle DM)	Alkoholeinwirkung	Kfz. nicht fahrbereit	Gefahrgut	§ 142 StGB
1			1	15500		1		

Unfallort (Gemeinde, Ortsteil, Kreis, Straße, Richtungsfahrbahn):
Gem.: Bad Camberg, Kreis: Limburg-Weilburg,
A. 3, Köln - Frankfurt/M

Innerorts = 1 außerorts = 2: 2 | Fahrtrichtung | Ordn.-Nr.: 1 | aufsteigend = 1 absteigend = 2: 1 | Straßenschlüssel | Haus-Nr.

Straße 1: Klasse A | Nr. 3 | km 124250 | NK-Kurzform | Stations-km

Straße 2: Klasse | Nr. | KB

Unfallkateg. | Unfalltyp | Sondererhebung | Unfallfolge 4 6 8 F | Sondermerkmal | gesteckt

Unfallhergang: Ordn. Nr. 01: 02: 03: 04: 05: 06:
(ggf. Handskizze)

0.1 kommt vermutlich infolge Reifenschadens hinten links nach links von der Fahrbahn ab und stößt gegen die Mittelschutzplanke.

Verkehrsstufe: - 1 -

OPEL ASTRA B

ON 01 (Opel Astra B) kommt vermutlich infolge Reifenschadens hinten nach links von der Fahrbahn BAB3 ab und stößt gegen die Mittelschutzplanke. Verkehrstufe 1 bedeutet flüssigen Verkehr.

Unfallart 37
- Zusammenstoß m. and. Fahrzeug, das anfährt, anhält o. i. ruh. Verkehr steht 1
- vorausfährt oder wartet 2
- seitlich in gleicher Richtung fährt 3
- entgegenkommt 4
- einbiegt oder kreuzt 5
- Zusammenstoß zw. Fzg. und Fußgänger 6
- Aufprall auf Hindernis auf Fahrbahn 7
- Abkommen von Fahrbahn nach rechts 8
- Abkommen von Fahrbahn nach links 9 — **9**
- Unfall anderer Art 0

Charakteristik der Unfallstelle 38-40: Kreuzung 1, Einmündung 2, Grundstücksein- oder -ausfahrt 3, Steigung 4, Gefälle 5, Kurve 6

Besonderheiten der Unfallstelle 41-43: Schienengleicher Wegübergang 2, Fußgängerüberweg (Z.293) 3, Fußgängerfurt 4, Haltestelle 5, Arbeitsstelle 6, Verkehrsberuhigter Bereich (Z. 325) 7

Lichtzeichenanlage 44: in Betrieb 8, außer Betrieb 9

Geschwindigkeitsbegrenzung 46 48 (durch Z.274/274.1 angeordnet - km/h)

Lichtverhältnisse 49: Tageslicht 0, Dämmerung 1, Dunkelheit 2 — **2**

Straßenzustand 52-53: Trocken 0, Naß/Feucht 1 — **1**, Winterglatt 2, Schlüpfrig (Öl, Dung, Laub usw.) 5

Aufprall auf Hindernis neben der Fahrbahn 55: Baum 0, Mast 1, Widerlager 2, Schutzplanke 3 — **3**, sonstiges Hindernis 4, kein Aufprall 5

Vorläufig festgestellte Ursachen
gemäß Verzeichnis Nr. 01-69
Ordn.-Nr. 1 | 88
Ordn.-Nr.
gemäß Verzeichnis 70-89: 89

• Reifenschaden

Folgeblatt

Ord. Nr.	wegen (Tatbestand oder TB-Nr.) verwarnt

14.09.98 (Datum)
/Heinrich, PCK (Unterschrift und Amtsbezeichnung d. aufnehmenden Beamten/-in)

Dienststelle Hessisches Polizeiverkehrsamt
Polizeiautobahnstation Idstein
Wiesbadener Str. 74 · Tel. 0 61 26 / 94 90-0
Fax 0 61 26 / 94 90 - 50
65510 Idstein

Tgb. Nr.: [redacted]

RP Kassel

Ordnungswidrigkeit
verjährt am:

naß. 23 Uhr
02.09.98

stands-

Protokoll-aufnahme

RB Krs Gem
439008
7 12

Unfallart	37
Zusammenstoß m. and. Fahrzeug, das anfährt, anhält o. i. ruh. Verkehr steht	1
vorausfährt oder wartet	2
seitlich in gleicher Richtung fährt	3
entgegenkommt	4
einbiegt oder kreuzt	5
Zusammenstoß zw. Fzg. und Fußgänger	6
Aufprall auf Hindernis auf Fahrbahn	7
Abkommen von Fahrbahn nach rechts	8 (8)
Abkommen von Fahrbahn nach links	9
Unfall anderer Art	0
Charakteristik der Unfallstelle	38-40
Kreuzung	1
Einmündung	2
Grundstücksein- oder -ausfahrt	3
Steigung	4
Gefälle	5
Kurve	6 (6)
Besonderheiten der Unfallstelle	41-43
Schienengleicher Wegübergang	2
Fußgängerüberweg (Z.293)	3
Fußgängerfurt	4
Haltestelle	5
Arbeitsstelle	6
Verkehrsberuhigter Bereich (Z. 325)	7
Lichtzeichenanlage	44
in Betrieb	8
außer Betrieb	9
Geschwindigkeitsbegrenzung (durch Z.274/274.1 angeordnet - km/h)	46 - 48 · 80
Lichtverhältnisse	49
Tageslicht	0
Dämmerung	1
Dunkelheit	2 (2)
Straßenzustand	52-53
Trocken	0
Naß/Feucht X	1 (1)
Winterglatt	2
Schlüpfrig (Öl, Dung, Laub usw.)	5

Behördenkennung (Dienststellen-Nr.) 2034 · 13 18

Unfalldatum (Tag/Monat/Jahr) 020998 · 19 24

Unfallzeit (h/min) 2300 · 25 26

Anzahl der Beteiligten	Getötete	Schwer-verletzte	Leicht-verletzte	Gesamtsachschaden (volle DM)	Alkohol-einwirkung	Kfz. nicht fahrbereit	Gefahrgut	§ 142 StGB
02				135000		2		
29 30	31 32	33 34	35 36		36A (78)	36B (79)		

Unfallort (Gemeinde, Ortsteil, Kreis, Straße, Richtungsfahrbahn):
BAB 3, Frankfurt/Köln, Gem. Idstein, km 131,350

innerorts = 1 / außerorts = 2: 2 · 13
Fahrt-richtung
Ordn.-Nr. 01
aufsteigend = 1 / absteigend = 2: 2 · 14
Straßen-schlüssel 15 23
Haus-Nr. 24 27

Straße 1: Klasse A · 28 · Nr. 3 · 29 32 · 33 · km 131350 · 34 39 · 40 43 · NK-Kurzform 44 46 · 47 · Stations-km 56 60

Straße 2: Klasse 48 · Nr. 49 52 · 53 · KB 54

Unfall-kateg. 61 · Unfall-typ 62 64 · Sonder-erhebung 65 67 · 68 78 · Unfallfolge 4 6 8 F · Sondermerkmal · gesteckt

Unfallhergang: Ordn. Nr. 01: [redacted] 02: [redacted]
(ggf. Handskizze) 03: 04: AUDI A8
MB C 05: 06:

ON 01 befuhr mit seinem Pkw die BAB 3 in o. g. Richtung, auf dem linken Fahrstreifen. Sein Pkw kam aus nicht ersichtlichen Gründen ins Schleudern und ON 01 kam dabei nach rechts von der Fahrbahn ab und prallte gegen die rechte Leitplanke. Von dort aus schleuderte dieser über die Fahrbahn und kam Höhe km 131,300 auf dem linken Fahrstreifen zumStehen.
ON 02 befuhr mit seinem Pkw ebenfalls den linken Fahrstreifen. ON 02 konnte den Pkw des ON 01 nicht rechtzeitig erkennen und wich nach rechts aus. Dadurch geriet der Pkw des ON 02 ins Schleudern. Dabei prallte dieser Höhe km 131,200 in die linke Leitplanke und kam dort anschließend zum Stehen. Es kam zu keinem Zusammenstoß zwischen den beiden Pkws.

Die Geschwindigkeitsbegrenzung 100 km/h (Z.274) wird bei km 131,5 aufgehoben.
150 km/h
Nach eigenen Angaben fuhren ON 01 und 02 beide 150 km/h.

ON 01 (MB C) befuhr die BAB3 in Richtung Frankfurt auf dem linken Fahrstreifen. MB C kam aus nicht ersichtlichen Gründen ins Schleudern, wonach er nach rechts von der Fahrbahn abkam und gegen die rechte Leitplanke prallte. Von dort aus schleuderte MB C über die Fahrbahn und kam in Höhe km 131,300 auf dem linken Fahrstreifen zum Stehen.

Da ON 02 (AUDI A8) MB C nicht rechtzeitig erkennen konnte, wich er nach rechts ab. Dadurch geriet AUDI A8 ins Schleudern. Er prallte gegen die linke Leitplanke in Höhe km 131,200 und kam dort anschließend zum Stehen.

Zu einem Zusammenstoß beider Fahrzeuge ist es nicht gekommen.
Bis bis zur Höhe km 131,5 gilt die Geschwindigkeitsbegrenzung von 100 km/h. Lt. eigener Angaben fuhren beide Fahrer **150 km/h** trotz der angeordneten Geschwindigkeitsbegrenzung von 80 km/h

Ordn.-Nr. 02 · 66 67 · 11 · 68 69 · 70 71 · 72 73
gemäß Verzeichnis 70-89 · 74 75 · 76 77

03.09.98
(Datum)

(Unterschrift und Amtsbezeichnung d. aufnehmenden Beamten/-in)

A6

Polizeiautobahnstation Idstein
Wiesbadener Str. 74 · Tel. 0 61 26/20 81
Fax 0 61 26/5 56 84
65510 Idstein

Tgb. Nr.:

An Bußgeldbehörde/Staatsanwaltschaft
Wiesbaden

Ordnungswidrigkeit verjährt am:

Eingangsstempel 8 16
02.02.97
✝ ✝ *1

Tatbestands- [x]
Protokollaufnahme [ ]
RB Krs Gem
439008
7 12

Unfallart	37
Zusammenstoß m. and. Fahrzeug, das anfährt, anhält o. i. ruh. Verkehr steht	1
vorausfährt oder wartet	2
seitlich in gleicher Richtung fährt	3
entgegenkommt	4
einbiegt oder kreuzt	5
Zusammenstoß zw. Fzg. und Fußgänger	6
Aufprall auf Hindernis auf Fahrbahn	7
Abkommen von Fahrbahn nach rechts	8
Abkommen von Fahrbahn nach links	9 [9]
Unfall anderer Art	0

Charakteristik der Unfallstelle	38-40
Kreuzung	1
Einmündung	2
Grundstücksein- oder -ausfahrt	3
Steigung	4 [4]
Gefälle	5
Kurve	6 [6]

Besonderheiten der Unfallstelle	41-43
Schienengleicher Wegübergang	2
Fußgängerüberweg (Z.293)	3
Fußgängerfurt	4
Haltestelle	5
Arbeitsstelle	6
Verkehrsberuhigter Bereich (Z. 325)	7

Lichtzeichenanlage	44
in Betrieb	8
außer Betrieb	9

Geschwindigkeitsbegrenzung 46 48 (durch Z.274/274.1 angeordnet - km/h)

Lichtverhältnisse	49
Tageslicht	0 [0]
Dämmerung	1
Dunkelheit	2

Straßenzustand	52-53
Trocken	0 [0]
Naß/Feucht	1
Winterglatt	2
Schlüpfrig (Öl, Dung, Laub usw.)	5

Aufprall auf Hindernis neben der Fahrbahn	55
Baum	0 [0]
Mast	1
Widerlager	2
Schutzplanke	3 [3]
sonstiges Hindernis	4 [4]
kein Aufprall	5

Vorläufig festgestellte Ursachen gemäß Verzeichnis Nr. 01-69
Ordn.-Nr. [01] 58 59 · 60 61 · 62 63 · 64 65
Ordn.-Nr. 66 67 · 68 69 · 70 71 · 72 73
gemäß Verzeichnis 70-89 74 75 · [89] 76 77
siehe Text

Behördenkennung (Dienststellen-Nr.) 34 — 13 18
Unfalldatum (Tag/Monat/Jahr) 020297 — 19 24
Unfallzeit (h/min) 0815 — 25 28

Anzahl der Beteiligten [1] 29 30 · Getötete [2] 31 32 · Schwerverletzte 33 34 · Leichtverletzte 35 36 · Gesamtsachschaden (volle DM) 41000 · Alkoholeinwirkung 38A (78) · Kfz. nicht fahrbereit [x] 38B (79) · Gefahrgut · § 142 StGB

Unfallort (Gemeinde, Ortsteil, Kreis, Straße, Richtungsfahrbahn):
Gem. Idstein, Rheingau-Taunus-Kreis, Autobahn Köln-Frankfurt, Fahrtrichtung Köln

Innerorts = 1 / außerorts = 2 [2] 13 · Fahrtrichtung · Ordn.-Nr. [01] · aufsteigend = 1 / absteigend = 2 [2] 14 · Straßenschlüssel 15 23 · Haus-Nr. 24 27

Straße 1: Klasse [A] 28 · Nr. 3 29 32 33 · km 127850 34 39 · 40 43 · NK-Kurzform 44 46 · 47 · Stationskm 56 60

Straße 2: Klasse 48 · Nr. 49 52 53 · KB 54

Unfallkateg. 61 · Unfalltyp 62 64 · Sondererhebung 65 67 · 68 78 · 4 6 8 F Unfallfolge · Sondermerkmal · gesteckt

Unfallhergang: Ordn. Nr. (ggf. Handskizze)
01: 02:
03: 04:
Zul. 08/93 05: MB E320 Kombi 06: 220 PS

01 befährt den linken Fahrstreifen und kommt in einer langgezogenen Linkskurve aus bisher ungeklärter Ursache mit den linken Rädern gegen den Bordstein.
Anschließend streift 01 leicht die Mittelschutzplanke.
01 wird von dort abgewiesen und überschlägt sich mehrmals in einer rechts angrenzenden Böschung

Verkehrsstufe:-1-

Vermerk: Das FZG. war rundum mit Reifen der Marke Michelin M+S, Größe 205/65R15 ausgerüstet. Die beiden linken Reifen waren ohne Luft, der Reifen hinten links war an der Flanke beschädigt. Die beiden rechten Reifen waren i. O.. Profiltiefe ca. 4mm.

*1 Two fatalities: passenger 47- and 41-year old

Folgeblatt [ ]

Ord. Nr.	wegen (Tatbestand oder TB-Nr.) verwarnt
	[redacted]

02.02.97 (Datum) — Weber, PHM Weber (Unterschrift und Amtsbezeichnung d. aufnehmenden Beamten/-in)

Vehicle	MB C	MB E320	MB E200 /WA	MB E230	MB E230 /WA	Opel Astra B
Crash test program	AMS Crash test	AMS Crash test	AMS Crash test	MBs Crash test	MBs Crash test	NCAP
yaw angle	nR	nR	nR	40^0	40^0	75^0
driver/co-driver	307/357 HIC	229/269	1238/ 200 (oM)	495/421	673/ 121 (oM)	555/296
Head deceleration	51/45 g	38/44	83/ 35 (oM)	57/52	68/ 30 (oM)	68/40
Head-inclined angle	$20^0/30^0$	5/30		40/38	50/ 33 (oM)	45/20
Chest deceleration	49/46 g	40/35	64/ 36 (oM)	46	65	45/39
Pelvis deceleration	72/68 g	43/50	50/ 49 (oM)			46/42
Femur-force	6858/2362 N	2200-1700 /1200-900	1480/2140			2400/1400
Seat-belt force	6015/6685 N	3000/3800	8220/8380	4650/6500	5500/6520	7000/7100
Airbag	64/155 l	67/150	none	none	none	60/120
Deployment time	19/22 ms	27/27				29/29

AMS (Auto Motor und Sport) Crash test =50 % Offset crash test of the vehicle at 55 km/h against a stiff barrier having 15^0 crash-surface
MBs Crash test = 50 % Offset crash test of two similar MBs at 55 km/h against each other
/WA = Without Airbag
(nR) = no result
(oM) = out of measurement range. Presumably, the accelerometer has a range between 0 to 100 g.

AMS issues of 19/1993, 22/1993, 19/1995, 13/1998 by Giok Djien Go 16.09.98

A9

	MB E320	MB E230/WA	AUDI A6	AUDI A6/WA
driver/co-driver	229/269 HIC	1238/200(oM)	413/360	2680
Head decelaration	38/44 g	83/35 (oM)	50/46	109
Head-inclined angle	5/30^0	-/-	25/50	
Chest decelaration	40/35 g	64/36 (oM)	47/45	75
Pelvis decelaration	43/50 g	50/49 (oM)	47/49	55
Femur-force	2200/1200 N	1480/2140	1200/1500	807
Seat-belt force	3000/3800 N	8220/8380	6900/8400	18906
Airbag	67/150 litre	none	75/130	none

(oM) = out of measurement range. Presumably, the accelerometer has a range between 0 to 100 g.
/WA = without airbag
German Auto Motor und Sport issues 19/95, 19/97, 7/96 by Giok Djien Go 30.07.97;

Prominent victim:
Rudolf Dressler, an executive member of SPD committee was jolted through the windshield of his AUDI A6 during the rollover after the collision at speed 120 km/h against a bridge-column on the highway Cologne-Bonn to Airport ref. to German newspapers "Die Welt" of 13.11.97, "Frankfurter Rundschau" of 12.11.97, "Süddeutsche Zeitung" of 13.11.97 etc.
The failure of three-point safety belt is due to
- lack of energy absorbers, X-shaped safety belt, method of gradually releasing large energy,
- high test value already at the speed over 55 km/h and
- non-deployment of airbag

thus yielding far large decelarations and seat-belt force, exceeding the threshold value of belt and ejecting the already-injured passenger by its own residual inertia force. The real values of AUDI A6/WA should be far greater. However, in order to obtain a result the multiplication of test value of AUDI A6 with the test value of MB 200/WA divided by the test value of MB 320 yields the respective value of AUDI A6/WA at speed 55 km/h.

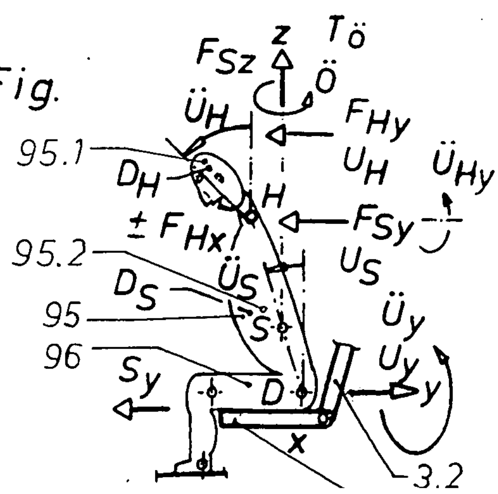
A10

+ A10a

	VW Golf IV	VW Golf IV in NCAP	Opel Astra B	Opel Astra B in NCAP
v	55 km/h	64.2	55	64.2
yaw angle	approx. 40^0	approx. 80^0		approx. 75^0
driver/co-driver	422/311 HIC	425/186	795/628	555/296
Head decelaration	58/43 g	50/33	74/60	68/40
Head-inclined angle	$35/55^0$	30/50	--/20	45/20
Chest decelaration	45/37 g	54/30	60/53	45/39
Pelvis decelaration	53/54 g	53/39	59/52	46/42
Femur-force	2700-2600/ 3900-900 N	2400-3000/ 3300-900	1300/2900	2400/1400
Seat-belt force	4600/5200 N	4500/5100	8000/8500	7000/7100
Airbag	64/114 litre		60/120	
Deployment time	26/26 ms	30/30	27/27	29/29
Displacement	15 cm	18	15	27
Distance from A- to B- pillar	-2 cm	-3	-2	-4
Force to open door	>500 N	430		

A10a

Fig.



AMS issues 23/97, 13/98 by Giok Djien Go 22.06.98

	Opel Omega	BMW 280i	MB E320	A8
driver/co-driver	372/470 HIC	266/395	229/269	531/424
Head decelaration	60/53 g	45/49	38/44	61/54
Head-inclined angle	xx/40^0	10/30	5/30	40/50
Chest decelaration	48/47 g	38/41	40/35	56/57
Pelvis decelaration	64/63 g	49/47	43/50	61/66
Thigh-force	2750/2180 N	1300/1100	2200/1200	2360/2610
Seat-belt force	6580/6160 N	3600/3400	3000/3800	9130/8510
Airbag	67/140 litre	62/135	67/150	70/150
Deployment time	34/38 ms	22/32	27/27	15/23
Displacement	17 cm	7	15	2
Distance from A- to B- pillar	-2 cm	-1	-3	-1
Force to open door	200 N	30	>500	50

AMS issues of 10/94, 19/95, 14/96 by Giok Djien Go 199(

Table 1

	left / right femur-force of driver	left / right femur-force of co-driver	belt-force of driver / co-driver	U_H
Fiat Tipo®	15190 N	nR N	5620 / 6100 N	20 / 80^0
Opel Corsa®	2258 / 2700	1381 / 2315	7030 / 7310	25 / 90
VW Polo®	2785	1587	5142 / 5655	45 / 70
Fiat Bravo®	3700	2300	nR / 6800	10 / 45
VW Golf®	2340	1630	6040 / 7050	50 / 50
MB C®	6858	2362	6015 / 6685	20 / 30
MB E200® ohne Airbag	1480	2140	8220 / 8380	/
VW Passat®	1600	2100	3400 / 4700	20 / 40
AUDI A6®	700 / 1200	1500 / 1100	6900 / 8400	25 / 50
Opel Omega®	2750	2180	6580 / 6160	nR / 40
BMW 528i®	1400 / 1200	900 / 1300	3600 / 3400	10 / 30
MB E320®	2200 / 1700	1200 / 900	3000 / 3800	5 / 30
AUDI A8®	2360	2610	9130 / 8510	40 / 50
BMW Z3®	1300 / 1400	1300 / 900	8300 / 4400	0 / 10
MB SLK®	5100 / 1700	800 / 4400	3300 / 3700	0 / 40
FB	nR / 8300	2733 / 3980	6144 / 5415	5 / 85
Renault Espace®	2037 / 11206	1323 / 1418	6829 / 7885	5 / 90
Opel Sintra®	4100	4700	5300 / 6400	60 / 30
VW Sharan®	2300	2600	6500 / 5700	35 / 70

FB = Peugeot 806®, Citroen Evasion®, Fiat Ulysse®, Lancia Zeta®
nR = no result

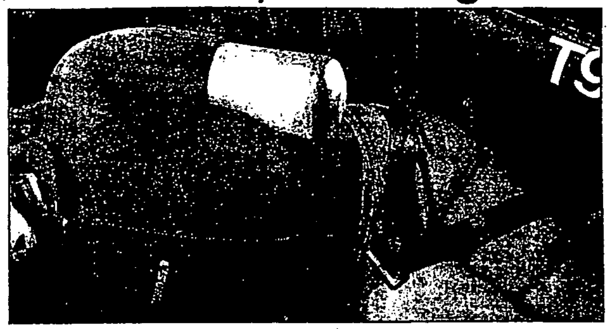
Table 2

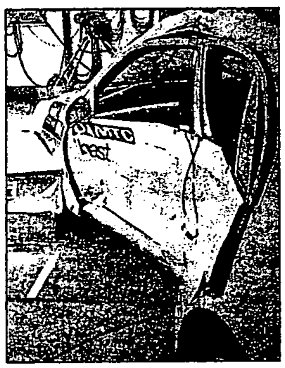
	yaw O of driver / co-driver
BMW Z3®	85 / 90^0
MB SLK®	100 / nR

Table 3

	force of head	acceleration of head	acceleration of chest	force of neck	forward motion
child-seat	696 HIC	65 g	59 g	1516 N	552 mm
AUDI A4®	392	49	45		
MB E320®	229	38	40		
child-seat to MB E320®	304 %	171 %	148 %		

Toyota, Mercedes, Volvo – nur ein System siegte





hat gute Chancen, tiefer in die Flanke zu stoßen.

Welche Systeme sollen das verhindern? Sehr weit verbreitet: sogenannte Aufprallschutzrohre in den Türen ohne weitere Maßnahmen an der herkömmlichen Karosse. Als Stellvertreter für dieses Prinzip mußte der Toyota Carina E in der viertürigen Stufenheckversion in die Prüfung. Zweite Alternative: Mercedes C 180. Er hat nicht nur eine steifere Karosseriestruktur, sondern soll mit weiteren gezielten Maßnahmen mehr Formstabilität der Fahrgastzelle gewährleisten und seitliche Intrusionen so klein wie möglich halten. Genug getan? Die Mercedes-Werbung verspricht jedenfalls einen »in dieser Klasse einmaligen Sicherheitsstandard«. Ein Volvo 850 kam in Frage, weil in ihm ein spezielles Seitenaufprallschutz-System verwirklicht wurde, das der Hersteller unter dem Kürzel SIPS (seit Herbst 94 zusätzlich mit Seiten-Airbags vorn) vermarktet.

Erster Testkandidat auf der Piste der BASt (Bundesanstalt für Straßenwesen): Toyota. Der Versuch lehnt sich an den europäischen Prüfvorschlag (siehe Kasten S. 22) an.

Das Ergebnis ist niederschmetternd: Ganz tief bohrt sich der Stoßkörper in die Fahrgastzelle, reißt auf dem Weg dorthin mit der mittleren Türsäule die Punktschweißung am Dachlängsträger ab und wölbt die Dachhaut deutlich auf. Auch der Tür-

Mercedes: Wenn die Türen nicht über die Schweller gedrückt werden, ist schon viel gewonnen (oben links). Toyota: Dummy ohne Sicherheitsgurt; Karosse eine Banane (oben rechts und Mitte links). Volvo: Der Seitenairbag ist die Trumpfkarte (Mitte rechts).

Die Testnoten: Euro-Seitencrash

Toyota Carina

Risiko für den Fahrer/Mitfahrer*		
Kopf	2,8	2,0
Brust	4,0	1,3
Bauch	5,0	2,5
Becken	3,0	4,0
Rettung	2,6	2,8
Gesamt	**3,4**	**2,5**

1 = sehr sicher, 5 = sehr unsicher
*auf dem Rücksitz links

Meßwerte

Belastung des Fahrers		Grenzwert	Meßwert
Kopf:	HIC 36	1000	441
Brust:	max. Eindr. Rippe mm	42	43
	max. VC Rippe m/s	1,0	1,4
Bauch:	Summenkraft kN	2,5	3,9
Becken:	kN	6	3,1

Meßwerte am Fahrzeug

Statische Deformationen innen in Höhe der	Brust	313 mm
	Hüfte	287 mm
	Oberschenkel	244 mm
	Armlehne	286 mm
außen im Bereich B-Säule (Maximalwert der Intrusion)		330 mm

HIC 36 = Index für Hirnbelastung; VC = Rippen-Eindringgeschwindigkeit; Intrusion = Eindringen.
Die Testnoten setzen sich aus der biomechanischen Belastung der Dummys und dem Crashverhalten der einzelnen Fahrzeugteile zusammen.

Die Testnoten: Euro-Seitencrash

Volvo 850

Risiko für den Fahrer/Mitfahrer*		
Kopf	1,0	2,0
Brust	2,5	1,5
Bauch	2,5	2,5
Becken	2,5	3,5
Rettung	2,6	2,6
Gesamt	**2,1**	**2,4**

1 = sehr sicher, 5 = sehr unsicher
*auf dem Rücksitz links

Meßwerte

Belastung des Fahrers		Grenzwert	Meßwert
Kopf:	HIC 36	1000	41
Brust:	max. Eindr. Rippe mm	42	33
	max. VC Rippe m/s	1,0	0,4
Bauch:	Summenkraft kN	2,5	1,3
Becken:	kN	6	2,2

Meßwerte am Fahrzeug

Statische Deformationen innen in Höhe der	Brust	156 mm
	Hüfte	119 mm
	Oberschenkel	112 mm
	Armlehne	149 mm
außen im Bereich B-Säule (Maximalwert der Intrusion)		189 mm

HIC 36 = Index für Hirnbelastung; VC = Rippen-Eindringgeschwindigkeit; Intrusion = Eindringen.
Die Testnoten setzen sich aus der biomechanischen Belastung der Dummys und dem Crashverhalten der einzelnen Fahrzeugteile zusammen.

Die Testnoten: Euro-Seitencrash

Mercedes C 180

Risiko für den Fahrer/Mitfahrer*		
Kopf	1,5	2,0
Brust	3,8	1,8
Bauch	2,5	1,5
Becken	2,5	2,5
Rettung	3,0	2,6
Gesamt	**2,6**	**2,1**

1 = sehr sicher, 5 = sehr unsicher
*auf dem Rücksitz links

Meßwerte

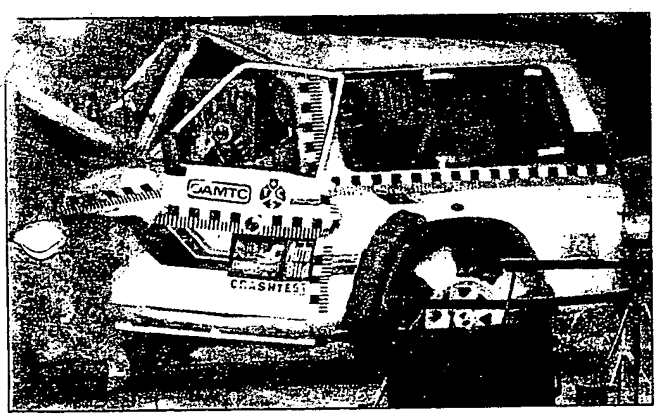
Belastung des Fahrers		Grenzwert	Meßwert
Kopf:	HIC 36	1000	113
Brust:	max. Eindr. Rippe mm	42	40
	max. VC Rippe m/s	1,0	1,3
Bauch:	Summenkraft kN	2,5	1,1
Becken:	kN	6	2,7

Meßwerte am Fahrzeug

Statische Deformationen innen in Höhe der	Brust	210 mm
	Hüfte	192 mm
	Oberschenkel	157 mm
	Armlehne	172 mm
außen im Bereich B-Säule (Maximalwert der Intrusion)		255 mm

HIC 36 = Index für Hirnbelastung; VC = Rippen-Eindringgeschwindigkeit; Intrusion = Eindringen.
Die Testnoten setzen sich aus der biomechanischen Belastung der Dummys und dem Crashverhalten der einzelnen Fahrzeugteile zusammen.

Fotos: Wilfried Göbel



Wie sich die Bilder gleichen: Beim versetzten Frontalcrash gegen die Barriere gibt es kaum Unterschiede zwischen altem (unten) und neuem Nissan Patrol (oben). Und die Wertung der Meßergebnisse bestätigt den optischen Eindruck im wesentlichen.

Eine Offensive gegen einen Importeur? Nein. Es ging um die Glaubwürdigkeit aller unserer vergangenen und künftigen Crashtests. Wir waren dem Verbraucher den Beweis schuldig, daß man sich auf unsere Erkenntnisse wirklich verlassen kann.

Eindeutiges Resultat nach dem neuen Crash: Der Fahrer-Dummy ist wieder der Dumme – die Meßergebnisse tendieren bei der Wiederholung sogar zu noch schlechteren Werten. Nur für den Rücksitzpassagier ist ein Trend zum Besseren zu erkennen.

Die tödliche Gefahr hinter dem Lenkrad mag Folge des Urmusters im Fahrzeugbau sein: Rahmen mit aufgesetzter Karosserie. Diese traditionelle Auslegung mit nur punktweiser Verbindung zwischen Leiterrahmen und Karosse erfüllt hier nicht die zeitgemäßen Crash-Anforderungen: Stoßaufnahme im Vorbau, stabile Fahrgastzelle zum Schutz der Insassen. Dazu ADAC-Ingenieur Bernhard Felsch, seit Jahren Projektleiter der ADAC-Crashtests: »Bei diesen Autos findet die Verformung nicht so gleichmäßig wie bei modernen Pkw-Karosseriestrukturen statt – sie gleicht eher einer erdbebenartigen Deformation.«

Wo die höchsten Belastungen für die Insassen auftreten, ist davon abhängig, wann welche Teile brechen. Beim Nissan macht, wie schon gehabt, der gegossene Längslenker der Vorderachse schlapp. Daraufhin knallen Rad und Vorderachse mit voller Wucht an vordere Türsäule sowie Stirnwand und helfen kräftig mit, den Fußraum beim Fahrer zu verkleinern und dort das Bodenblech aufzuwölben. Die Pedale schnellen zusätzlich in den Beinbereich der Meßpuppe und klemmen die Füße ein. Außerdem schmettert der aufsteigende Fußboden die Unterschenkel samt Knie von unten in das Armaturenbrett. Besonders arm ist das linke Knie dran, das schmerzhaften Kontakt zu einem zerklüfteten Bereich des Armaturenträgers bekommt, wo sich hervorstehende Knöpfe und Zughebel gruppieren.

Und auch diesmal wird der Kopf des Dummys vom Lenkrad erbarmungslos gebremst. Er trifft nun weniger den nachgiebigen Lenkradbogen, sondern bleibt eher am Rand des metallischen Prallelements der Lenkradnabe hängen. Deswegen höherer Meßwert: HIC 1006, also hart am Grenzwert. Außerdem versetzt der Bomben-Stoß den Kopf in eine unnatürlich scharfe Rotation, die zusätzliche Verletzungsrisiken in sich birgt. Die Kopfbeschleunigung über drei Millisekunden liegt mit 96,3 g wieder eindeutig über dem Grenzwert von 80 g. Einige g hin oder her sind hier in der Wirkung für den Fahrer zwar nicht von großer Bedeutung, aber die Höhe an sich zeigt noch einmal deutlich, welche Gefahr beim Frontcrash im

Die Testnoten:

Frontalcrash

Nissan Patrol GR	Modell 90	94
Risiko für den Fahrer		
d. Lenkrad	5,0*	5,0*
d. Armaturenbrett	3,5	4,0
d. Fußraum	4,0	4,5
d. Sitz und Gurt	3,4	3,5
bei der Rettung	4,4	3,7
Risiko auf dem Rücksitz		
durch Sitz u. Gurt	3,9	3,8
bei der Rettung	3,3	3,0

1 = sehr niedrig, 5 = sehr hoch
*wegen zu großer horizontaler Lenkradintrusion

Meßwerte

Belastung des Fahrers		Grenzwert	Nissan Patrol Modell 90	94
Kopf:	HIC 36	1000	4 518	1006
	Res. Beschl. 3 ms	80 g	103,4 g	96, 3 g
Brust:	Res. Beschl. 3 ms	60 g	25,6 g	37,0 g
Becken:	Res. Beschl. 3 ms	60 g	22,7 g	32,6 g

Meßwerte am Fahrzeug			
Vorbau:	Max. Verzögerung	20 g	31,4 g
	Max. dyn. Deformation	1058 mm	1011 mm
Zelle:	Deformation A-Säule	120 mm	168 mm
	Deformation Fußraum	32 %	22 %
Lenkrad:	Intrusion horizontal	180 mm	192 mm
	Intrusion vertikal	100 mm	124 mm
Armatur:	Intrusion horizontal	160 mm	191 mm

Offset-Crash mit ca. 40% Überdeckung gegen die starre Barriere, 50 km/h

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pp 24
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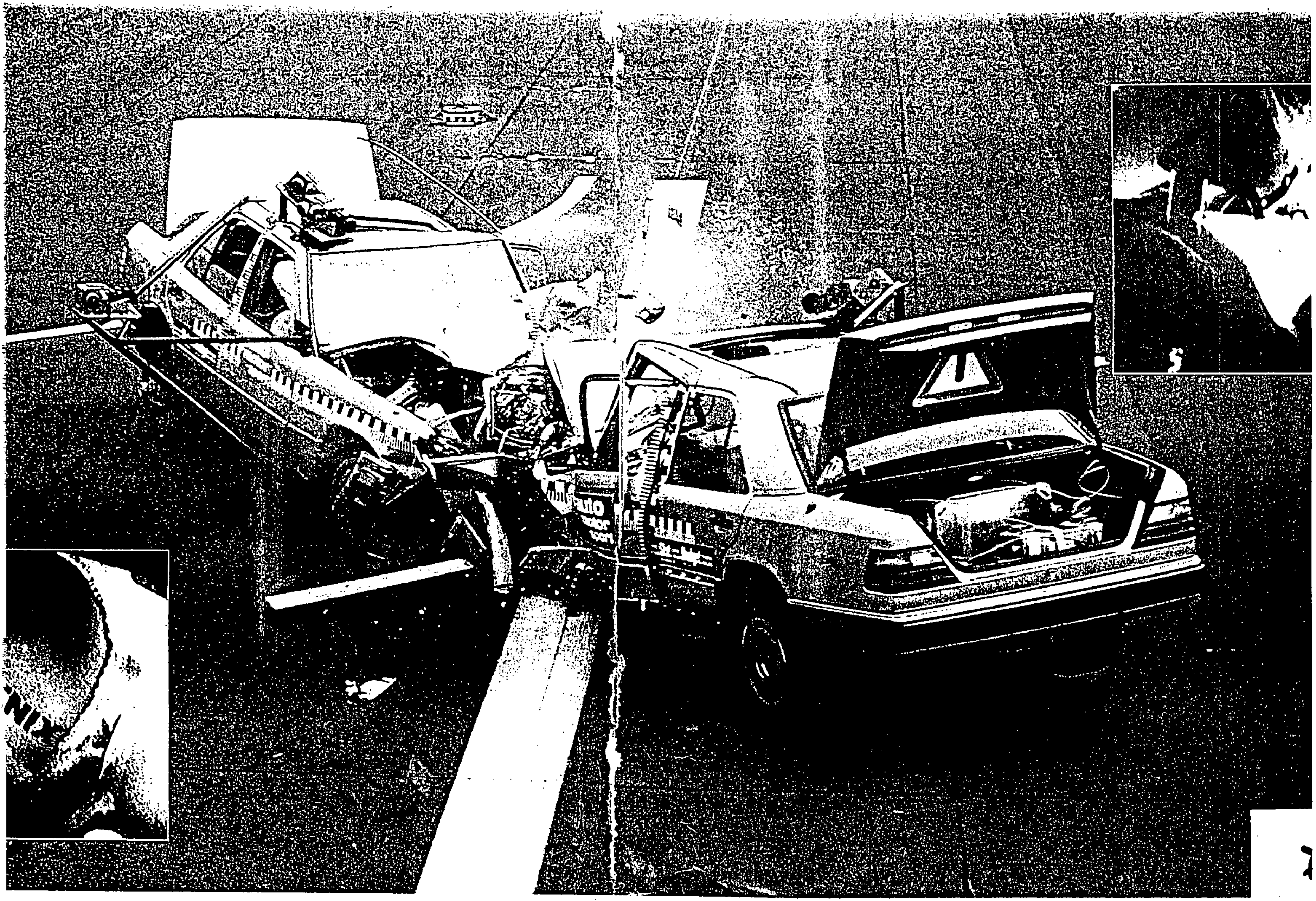
A14



Durch den harten Offset-Aufprall werden die beiden Autos um etwa 40 Grad nach links verdreht

Automobile

Irdische Ängste

Der neue Großraumwagen Chevrolet Trans Sport soll praktischer und sicherer sein als sein Vorgänger. Ein Crashtest weckte Zweifel.

Auf dem Pariser Salon begegneten Manager von General Motors (GM), dem größten Autohersteller der Welt, kürzlich einem Kunden. Der Mann war Franzose und gab sich als Besitzer der GM-Großraumlimousine Pontiac Trans Sport zu erkennen. Im übrigen war er erzürnt.

Der Nachfolger des Trans Sport, der 1997 in Europa unter der GM-Marke Chevrolet zu Preisen ab etwa 60000 Mark verkauft werden soll, feierte in Paris Premiere. Der Kunde zeigte auf den neuen Wagen, nannte ihn „altmodisch und abscheulich", gelobte, ihn nicht zu erwerben, und entschwand.

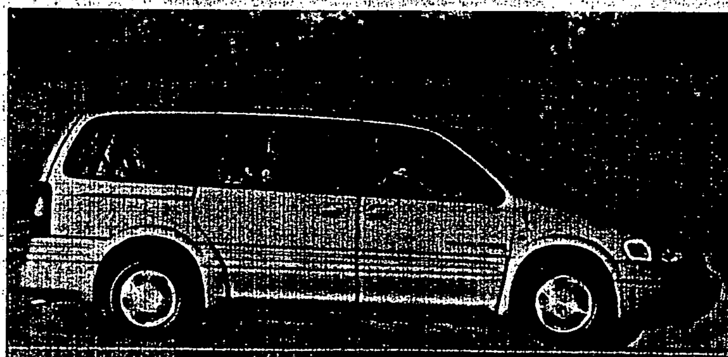
Die GM-Manager zeigten sich weder erfreut noch überrascht. Einen Teil der Klientel zu verprellen zählte zum Designkonzept des neuen Trans Sport. Es markiert das Ende einer futuristischen Irrfahrt.

Der Vorgänger des Trans Sport, der 1989 in den USA und ein Jahr später in Europa vorgestellt worden war, hatte noch den Eindruck erweckt, er sei aus fernen Galaxien angereist. „Völlig losgelöst von allem irdischen Design", so das Fach-Magazin *Auto, Motor und Sport*, durchglitt er nach Art des Space-Shuttle mit einer keilförmigen Wagenfront und nahezu schwarz verdunkelten Scheiben das Einerlei der automobilen Gegenwart. An seinen Hecksäulen erstrahlten Lichterketten wie Sternschnuppen. Eine „lange Zukunft" sagte die Fachpresse dem fremdartigen Vehikel voraus.

Doch bald erwies sich die kühne Styling-Offensive als Fehlschlag. Konventionelle Vans im biederen Kleinbus-Zuschnitt dominieren den Markt in Europa und den USA, wo der Raumgleiter von GM ob seiner pseudoastronautischen Anmutung mehr Hohn als Lob einfuhr. Spötter nannten ihn „Dust Buster" wegen seiner Ähnlichkeit mit gebräuchlichen Tischstaubsaugern.

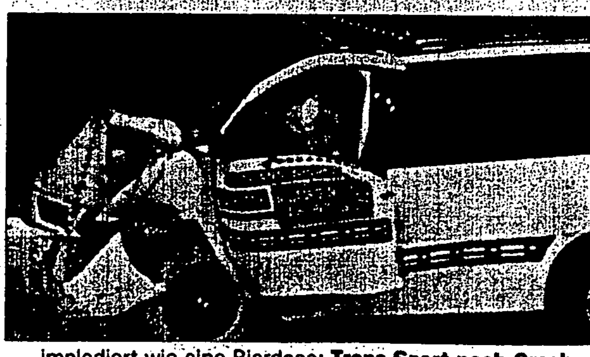
Der neue Trans Sport, der in einer kürzeren Version unter dem Namen Sintra auch von der GM-Tochter Opel angeboten wird, trägt nun ein deutlich konventionelleres Kleid. „Vom sogenannten One-box-Design", so eine GM-Verlautbarung, wurde Abschied genommen, zugunsten einer „klaren optischen Trennung von Motor und Innenraum". Windschutzscheibe und Motorhaube bilden also nicht mehr eine Linie.

Das bringt zwei klare technische Vorteile: Da die Windschutzscheibe steiler steht, heizt sich der Innenraum nicht mehr so stark auf. Außerdem ist eine Fahrzeugfront mit flacherer Motorhaube besser überschaubar. Die Lenker des Vorgängermodells kamen zuweilen beim Rangieren in der terrestrischen Enge urbaner Parklücken in Verlegenheit. Sie sahen das vordere Ende des Raumgleiters nicht.



WERKFOTO

Neuer Chevrolet Trans Sport: Trotz ausgeklügelter Längsträger ...



... implodiert wie eine Bierdose: **Trans Sport nach Crash**

In den Werksverlautbarungen zum neuen Trans Sport überwiegen nun stockrationale Argumente: Der „platzsparende Quereinbau" des V-Sechszylinders (186 PS) habe ein „einzigartiges Raumangebot" zur Folge. Selbst wenn alle sieben Sitze belegt seien, stehe hinter der dritten Sitzreihe noch ein stattliches Kofferraumvolumen von 685 Litern zur Verfügung. In den meisten Vans, auch im kürzeren GM-Bruder Opel Sintra, bleibt bei voller Passagier-Belegung nur noch sehr wenig Platz für Gepäck.

Um den Insassen des Raumfahrzeugs auch alle irdischen Ängste zu nehmen, behauptet GM, die Konstrukteure hätten „keine Abstriche bei der Sicherheit" zugelassen. Ein „ausgeklügeltes System exakt aufeinander abgestimmter Längsträger" absorbiere die Aufprallenergie und schütze die Insassenzelle.

Zweifel an solchen Versprechungen nährte allerdings ein kürzlich von amerikanischen Versicherungsfachleuten des Insurance Institute for Highway Safety (IIHS) vollzogener Crashtest. Die Experten ließen neun Vans mit 40 Meilen (64 km/h) frontal gegen eine seitlich versetzte Ziegelwand schmettern. Nur einer, der Ford Windstar, überstand den Aufprall zufriedenstellend.

Am schlechtesten schnitt der Trans Sport ab. Seine Frontpartie „implodierte wie eine leere Bierdose", schrieb die *Los Angeles Times*. Der Fußraum wurde zerquetscht, und die Lenksäule ragte schließlich unter das Kinn des Fahrer-Dummies. Test-Versuchsleiter Brian O'Neill: „Es war schlimmer als alles, was wir je sahen."

GM-Sprecher Bill O'Neill setzte solchen Unheilsmeldungen sogleich eine schriftliche Stellungnahme entgegen, die jedoch eher den Charakter einer Entschuldigung trug. 72 Crashtests habe der neue Trans Sport vor dem Serienstart durchlaufen, allerdings nicht so schwere. Weniger als 0,4 Promille aller realen Unfälle, beteuerte O'Neill, spielten sich in diesem extremen Bereich ab.

Tatsächlich zweifeln viele Unfallexperten zunehmend am Sinn solch extremer Crashversuche. Je höher die Aufprallgeschwindigkeit, auf die ein großer Wagen ausgelegt wird, desto gefährlicher wird es beim Zusammenstoß für einen Kleinen. Mit seiner steifen Front würde der dermaßen optimierte Van ein leichtes Auto glatt niederwalzen.

Mit solchen Argumenten gegen die Crashaktion des IIHS zu wettern, wagt General Motors vorerst jedoch nicht. „Es wäre doch irgendwie peinlich", erklärt ein europäischer GM-Mitarbeiter, „wenn ausgerechnet der Schlechteste im Test am lautesten schriee."

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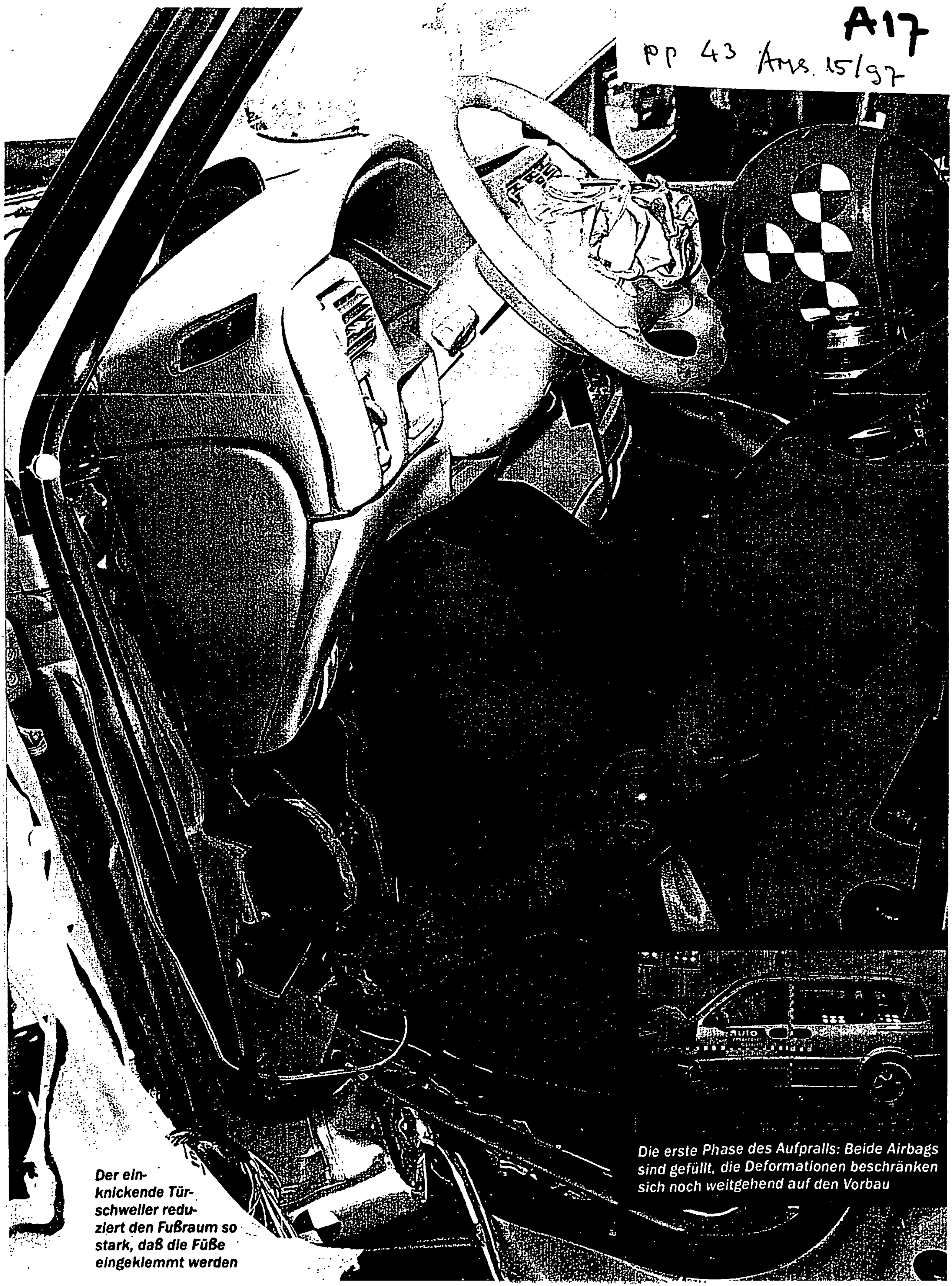


Die erste Phase des Aufpralls: Beide Airbags sind gefüllt, die Deformationen beschränken sich noch weitgehend auf den Vorbau

Der einknickende Türschweller reduziert den Fußraum so stark, daß die Füße eingeklemmt werden

A18

VW Polo is built in 1994, VW Sharan in 1996 and Opel Sintra in 1997.

	VW Polo	VW Sharan	Opel Sintra	Peugeot 806	Renault Es
driver/co-driver	433/529 HIC	461/662 HIC	499/321	901/1265	888/842
Head decelaration	52/50 g	55/57 g	58/49	83/98	90/66
Head-inclined angle	45/70^0	35/70^0	60/30	5/85	5/90
Chest decelaration	47/46 g	37/37 g	37/42	61/59	67/41
Pelvis decelaration	54/48 g	43/52 g	45/49	76/51	58/44
Femur-force	2785/1587 N	2300/2600 N	4100/4700	xx-8300 /2733-3980	2037-11206 /1323-1418
Seat-belt force	5142/5655 N	6500/5700 N	5300/6400	6144/5415	6829/7885
Airbag	35/63 litre	35/60 litre	60/120	45/	30/
Deployment time	28/34 ms	38/47 ms	32/32	21/	40/
Displacement	18 cm	67 cm	82	66	72
Distance from A- to B- pillar		-4 cm	-23	-4	-3
horiz./vertical steering column		-1/-10 cm	-18/-29	-3/-6	
Force to open door		∞ N	∞	>500	<500

AMS issues of 25/94, 6/95, 17/95, 15/97 by Giok Djien Go 13.10.98

FAZ 13.10.98

A19

Schwache Seiten am Auto stärken

Versicherer fordern mehr passive Sicherheit / Fatale Seitenkollisionen

„Das Risiko, bei einer Seitenkollision getötet zu werden, ist überdurchschnittlich hoch." Das ist die wohl wichtigste Erkenntnis, die die Unfallforscher des Institutes für Fahrzeugsicherheit im Gesamtverband der Deutschen Versicherungswirtschaft e.V. (GDV) gewonnen haben. Sie basiert auf einer jetzt in München vorgestellten Studie, die allerdings noch auf Fällen aus dem Jahre 1990 beruht. Dabei geht es um Unfälle auf Land- und Bundesstraßen, die sich zu über zwei Drittel nach dem gleichen Muster ereignen: Ein Wagen schleudert auf die Gegenfahrbahn und wird dort von einem entgegenkommenden Fahrzeug auf der Beifahrerseite getroffen. Daraus resultieren häufig tödliche Verletzungen für den Fahrer, obwohl dieser auf der kollisionsabgewandten Seite sitzt. Die Fahrgeschwindigkeiten liegen zwischen 60 und 130 km/h; nur in 5 Prozent der Unfälle war der Verursacher schneller.

Um diese schlimmen Seitenkollisionen zu verhindern oder zumindest ihre Folgen zu mindern, formulierte Professor Klaus Langwieder, Leiter des Instituts, einige Empfehlungen: Es sollten möglichst in allen Fahrzeugklassen elektronische Fahrdynamikregelungen (ein Beispiel ist das bereits in einigen Modellen verwendete ESP) eingebaut werden, die weit besser als der Mensch Fahrfehler automatisch korrigieren können und das Fahrzeug mit verminderter Geschwindigkeit weiter auf Kurs halten. So wie mittlerweile Fahrer- und Beifahrerairbag zur Serienausstattung von Neuwagen gehören, sollte möglichst bald in jedem Wagen auch ein Seitenairbag-System enthalten sein. Seine Wirkung sollte den Schutz von Brust-, Becken- und Kopfbereich umfassen und möglichst lange anhalten, um die Insassen vor eindringenden Strukturteilen zu bewahren. Weil 30 Prozent der getöteten Insassen nicht angeschnallt waren, appellierte Langwieder an die Vernunft der Autofahrer und an die Industrie, „intelligente Angurt-Erinnerer" einzubauen; aktuelle Untersuchungen haben ergeben, daß man sich auf den Vordersitzen zu 92 Prozent, auf den Rücksitzen aber nur zu 60 Prozent angurtet. Sorgen macht den Unfallforschern auch das sogenannte Kompatibilitätsrisiko. „Kleinere Fahrzeuge sind mit doppeltem Risiko unterwegs", sagte Langwieder. Um die „Massenaggressivität" großer, schwerer und steifer Fahrzeuge auf Kleinwagen zu reduzieren, forderte er Crash-Tests mit „intelligenter Barriere". Jedoch wird ein in Europa veranstalteter Test seit neuestem statt mit 56 km/h mit 64 km/h (das bedeutet 30 Prozent mehr Energie) gefahren. Das könnte zur Folge haben, daß die Automobile in Zukunft mit härterer Struktur konstruiert werden. Das Institut des GDV hat festgestellt, daß neben dem Seitencrash auch Fuß- und Beinverletzungen durch eine entsprechende Konstruktion des Fahrzeugs vermindert werden könnten. In der jetzt vorgelegten Untersuchung hat man erstmals auch die Folgen der Unfälle mit den Kosten für Heilung und Rehabilitation bewertet. Obwohl beispielsweise beide Verletzungsarten wie die Gehirnerschütterung und die Fersenbeinfraktur als mittelschwer eingestuft werden, verursachen sie höchst unterschiedliche Kosten: Gehirnerschütterung 4000 Mark, der Bruch des Fersenbeins wegen langer Liege- und Rehabilitationszeiten rund 200 000 Mark; die volkswirtschaftlichen Kosten sind noch nicht mitgerechnet. Um sie zu senken, sind weitere Änderungen zugunsten der passiven Sicherheit nötig. Nach den Verbesserungen im oberen Teil des Armaturenträgers müßte jetzt der Blick gesenkt werden. So sollten die Fahrzeughersteller den Fußraum optimieren, die Pedalaufhängung entschärfen und möglichst den unteren Teil des Amaturenbretts polstern.

GERD GREGOR FETH

ms 7/94 (Ford Fiesta), 8/96, 8/97

	Ford Fiesta
ahrer [1]	540
eifahrer	562
rzögerung (g)[2]	76
rzögerung rer (g)	54
nkel (Grad)	40
nkel rer (Grad)	75
rzögerung (g)	47
rzögerung er (g)	37
verzögerung (g)	38
verzögerung er (g)	45
henkelkraft (N)[3]	10030/2900
henkelkraft er (N)	910/1640
ft Fahrer (N)	5320
it Beifahrer (N)	6060
olumen Beifahrer (L)	30/60
eit nach Fahrer/Beif.[4]	35/42

Astra

Dummy-Werte	Opel[1] Astra (A)	VW[1] Golf III (III)
Kopfverletzungs-kriterium Fahrer (HIC)[1]	664	706
Kopfverletzungs-kriterium Beifahrer (HIC)	382	590
Resultierende Kopfverzögerung Fahrer/Beifahrer (g)[2]	69/51	67/57
Kopf-Nickwinkel Fahrer/Beifahrer (Grad)	35/90	50/50
Resultierende Verzögerung Brust Fahrer/Beifahrer (g)	58/37	48/43
Resultierende Verzögerung Becken Fahrer/Beifahrer (g)	72/46	46/46
Oberschenkelkraft Fahrer (N)[3]	8050	2340
Oberschenkelkraft Beifahrer (N)	2030	1630
Gurtkraft Fahrer (N)	6260	6040
Gurtkraft Beifahrer (N)	6100	7050
Airbagvolumen Fahrer/Beifahrer (L)	65/–	35/65
Auslösezeit nach Aufprall Fahrer/Beifahrer (ms)[4]	25/–	47/58

Ford Fiesta 1090 kg

VW Golf III 1239 kg

al weight-incompatible accident on the state road (A20) a 1239 kg-heavy VW Golf III, out of controll due to higher speed, frontally collided against a 1090 kg-heavy Ford a. Due to greater impact energy than that of VW Golf III, fatal femur force of 10030 N, x. **five times** higher than that of VW Golf III in AMS Crash test, large belt force of 5320 27-year old female Ford-driver, suffering from **greater yaw- and whiplash-acceleration** ndent force and being **thoroughly clamped** in the totally deformed passenger cell, was ntly fatally injured at the accident site, whereby the 43-year old female VW-driver, ring from head- and minor injury, could be treated at the hospital.

WT 2.1.97

Kollission in der Kurve

Wörsdorferin starb bei Unfall auf der B 275 in der Silvesternacht

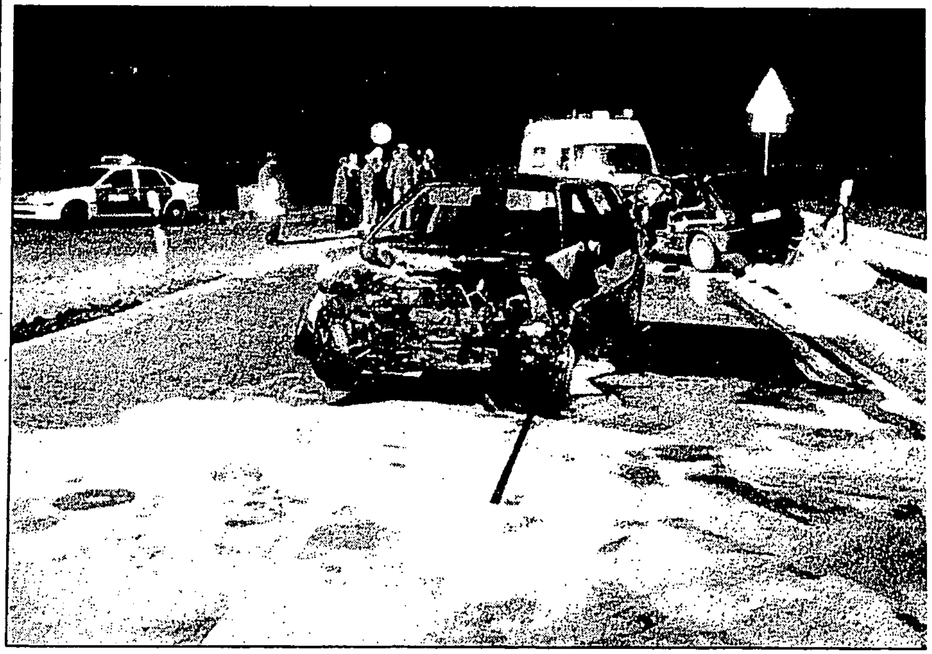
tt. IDSTEIN – Eine 27jährige Frau aus Wörsdorf kam in der Silvesternacht bei einem grauenvollen Verkehrsunfall auf der B 275 zwischen Idstein und Esch ums Leben.

Der schwere Unfall ereignete sich gegen 21.20 Uhr kurz hinter der Abfahrt Bermbach in einer Rechtskurve. Eine 43jährige Fahrerin aus Butzbach geriet mit ihrem VW-Golf auf regennasser Fahrbahn ins Schleudern, weil sie, so vermutet die Polizei, mit nicht angepaßter Geschwindigkeit unterwegs war.

Der Golf kam auf die Gegenfahrbahn und stieß dort mit einem entgegenkommenden Ford Fiesta frontal zusammen. Dabei wurde die junge Wörsdorferin in ihrem Ford eingeklemmt und so schwer verletzt, daß sie noch an der Unfallstelle starb.

Die Frau aus Butzbach trug Kopfverletzungen und Prellu gen davon und mußte zur B handlung in ein Krankenha gebracht werden. Der Sac schaden summierte sich na Auskunft der Polizei in Wie baden auf schätzungswei 25 500 Mark.

Während der Unfallaufna me mußte die Bundesstraße b gegen 23.30 Uhr für den Ve kehr voll gesperrt werden. Ei Sachverständiger nahm sei Arbeit auf.



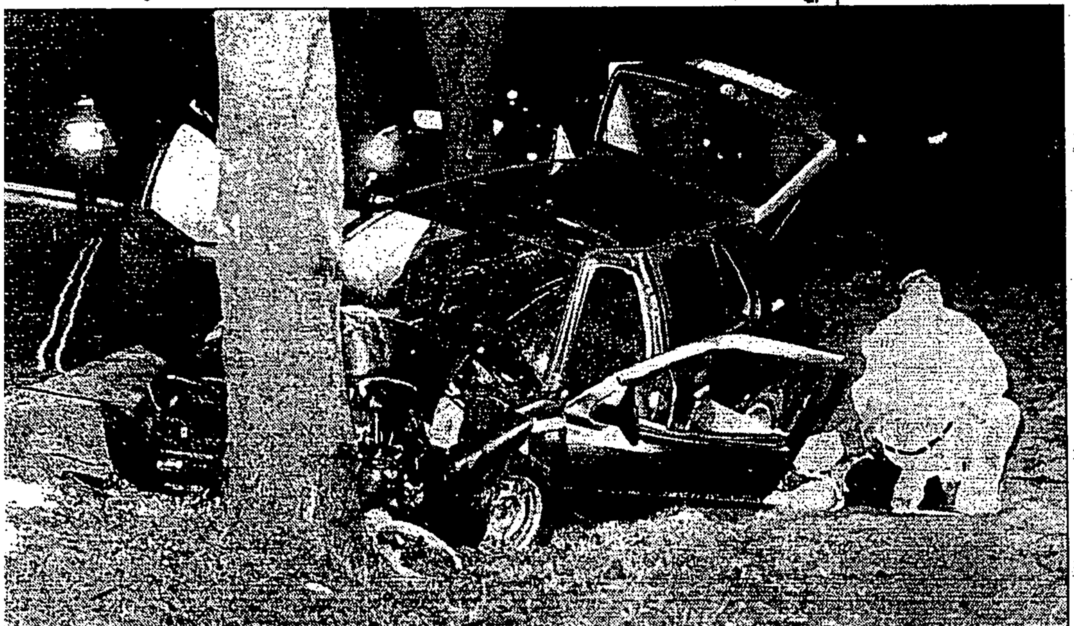
Frontal stießen die beiden Wagen zusammen. Eine 27jährige Frau aus Wörsdorf wurde in ihrem For Fiesta (hinten) so schwer verletzt, daß sie nicht überlebte. Bild: w

u 23 02 97

WK 24.2.97

VW Golf III

B1



...ede Hilfe kam zu spät für den Wallufer, der in der Nacht zum Sonntag mit seinem Wagen auf der ...äderstraße verunglückte. Bild: Uwe Stotz

Wallufer starb bei Unfall auf der Bäderstraße

WALLUF – Ein 32jähriger Mann aus Walluf ist in der Nacht zum Sonntag auf der Bäderstraße B 260 bei einem Unfall ums Leben gekommen. Nach Auskunft der Polizei in Eltville war er gegen 3.30 Uhr allein in seinem Wagen unterwegs von Eltville-Martinsthal kommend Richtung Autobahn. Aus bisher ungeklärten Gründen geriet er in Höhe Oberwalluf von der Straße nach links ab und prallte gegen einen Baum.

Aus den Spuren auf der Straße sei zu erkennen, daß der Fahrer vor dem Aufprall eine Vollbremsung gemacht hat. Warum der Mann auf der fast geraden Strecke von der Fahrbahn ab kam, war den Ermittlern gestern noch rätselhaft. Sie gingen davon aus, daß kein zweites Fahrzeug bei dem Unglück eine Rolle gespielt hat. Der Wallufer starb noch am Unfallort. Die B 260 blieb bis gegen 5.45 Uhr gesperrt.

...easures against the failure of the passenger protection of the new model VW Golf in ...e event of an arbitrary front collision on the road (*not highway*) by means of DE ...615985, DE-OS 4342038, PCT/DE96/02120 (DE 19543706 +19645925) ...d DE 19636167 with the following features:

- pairwise, independently operating piston devices to independently deform the respective deformable elements,
- interlocking the retaining pairs of *all pairwise vehicle parts* vehicle door / vehicle roof, vehicle door / side rail, vehicle door / post section(s), vehicle door / passenger compartment and vehicle doors in series to increase the stiffness and
- detachment of the engine-gear unit from one or both runners to release the kinematic energy of unit and to prevent against the intrusion of unit into the passenger compartment.

Maßnahmen gegen das Versagen des Insassenschutzes des Neumodelles VW Golf bei beliebigen (Offset) Frontaufprall auf der Bundesstraße (*nicht Autobahn*) mittels DE 19615985, DE-OS 4342038, PCT/DE96/02120 (DE 19543706 +19645925) und DE 19636167 mit folgenden Merkmalen:

- paarweise voneinander unabhängig wirkende Kolbenvorrichtungen zwecks voneinander unabhängiger Verformung ihrer Deformationselemente,
- Aneinanderkeilen der außen einstellbaren Halterungspaare *aller zugehörigen Fahrzeugteile* Fahrzeugtür / Dach, Fahrzeugtür / Schweller, Fahrzeugtür / Säule(... Fahrzeugtür / Fahrgastzelle und nebeneinanderliegender Fahrzeugtüren zwecks Steifigkeitserhöhung und
- Aggregatstrennung von einem oder beiden Längsträgern zwecks Freisetzen der kinetischen Energie des Aggregates und Vermeiden gegen das Eindringen des Aggregates in die Fahrgastzelle.

Energy-absorption capacity pending patented by DE 4224489 A1 is limited due to buckling the deformable elements of longitudinal runner of AUDI A8, thus transmitting the residual energy to the passenger cell and passengers exposed to great accelerations. This energy-absorption capacity is optimized by the measures of patent DE 19636167 C1 to

B2

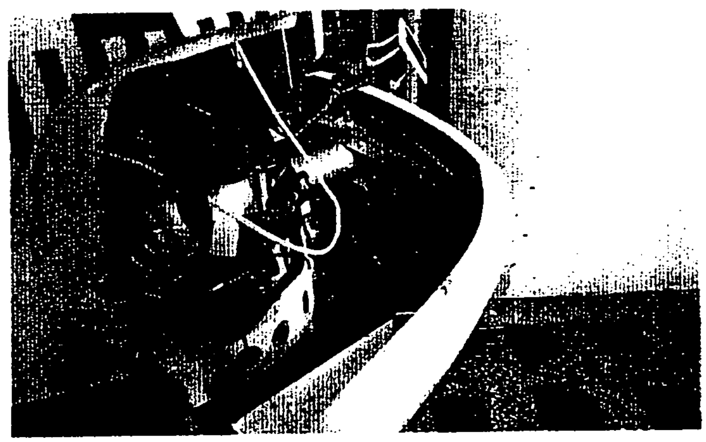
- determine the steps of releasing the impact energy by means of a well-defined controllable deformation behaviour of the deformable longitudinal runner to effectively exploit the material during the folding and buckling,
- guide the runner by piston rod during the deformation and
- ream the runner by the cone hub to increase the capacity.

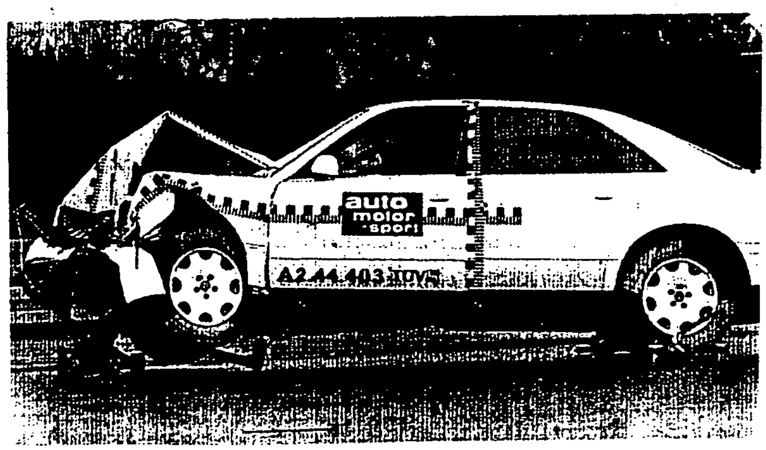
Audi A8

AMS 10/94

Dummy-Werte	
Kopfverletzungskriterien Fahrer (HIC)[1]	
Kopfverletzungskriterien Beifahrer (HIC)	
Resultierende Kopfverzögerung Fahrer (g)[2]	
Resultierende Kopfverzögerung Beifahrer (g)	
Kopf-Nickwinkel Fahrer/Beifahrer (Grad)	
Resultierende Verzögerung Brust Fahrer (g)	
Resultierende Verzögerung Brust Beifahrer (g)	
Resultierende Verzögerung Becken Fahrer/Beifahrer (g)	
Oberschenkelkraft Fahrer (N)[3]	
Oberschenkelkraft Beifahrer (N)	
Gurtkraft Fahrer (N)	
Gurtkraft Beifahrer (N)	
Airbag-Volumen (Liter) Fahrer/Beifahrer	
Auslösezeit nach Aufprall Fahrer/Beifahrer (ms)[4]	

[illegible]	
Crashgewicht (kg)	
Aufprallgeschwindigkeit (km/h)	
Deformationsweg (cm)	
Lenksäulenverschiebung horizontal (cm)	
Lenksäulenverschiebung vertikal (cm)	
Armaturenbrettverschiebung horizontal (cm)	
Armaturenbrettverschiebung vertikal (cm)	
Pedalverschiebung horizontal (cm)	
Pedalverschiebung [illegible]	





Runde Pralldämpfer leiten die Kraft in den Space Frame, der die Fahrgastzelle wie ein Sicherheitskäfig umschließt

BMW 7

B3b

WT. 21.11.97

Eine Tote, ein Schwerverletzter:

Wohl wegen überhöhter Geschwindigkeit kam ein Ehepaar aus Gau-Odernheim Mittwoch abend von der Straße ab, prallte am Ortsausgang gegen einen Baum. Die 29jährige war sofort tot, der 31jährige kam schwerverletzt in eine Mainzer Klinik. Bild: Schmitz

OPEL CORSA

B3c

WT

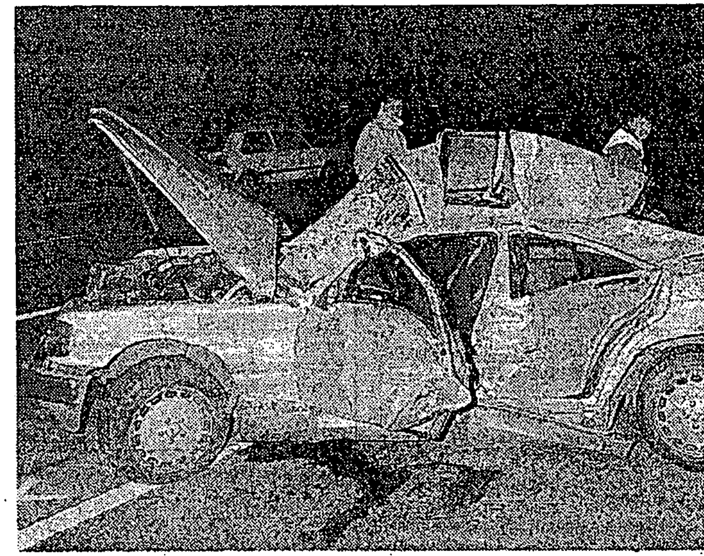
Unfall auf nasser Fahrbahn: eine Tote 7/10/96

Eine Tote und einen Schwerverletzten forderte ein Unfall auf der Autobahn A 67 zwischen Gernsheim und Lorsch. Der Wagen eines

MB 190

B3a

Samstag, 3. Dezember 1994 W.K.



Ein 37jähriger Mann starb auf der Autobahn A 5 nahe Frankfurt, als sein schleuderndes Auto am Freitag morgen auf einen Lkw prallte. Bild: dpa

Tod durch Straßenglätte

Zahlreiche schwere Unfälle in Hessen / Erneut Frost

FRANKFURT (lhe) — Wenige Stunden nach der ersten Glättewarnung für Hessens Autobahnen in diesem Winter ist ein 37 Jahre alter Mann am Freitag morgen in seinem Auto auf reifglatter Straße tödlich verunglückt. Bei zahlreichen anderen Glatteisunfällen sei es vor allem zu Blechschäden und wenigen leichten Verletzungen der Autofahrer gekommen, teilte die Polizei mit.

Im nordhessischen Schwalm-Eder-Kreis wurden 17 Glatteisunfälle gezählt. Nach Angaben der Verkehrsleitstelle in Wiesbaden kam es vor allem an den Frankfurter, Bad Homburger, Schiersteiner und Kasseler Autobahnkreuzen zu Auffahrunfällen.

Die Frostgrenze lag nach einem Bericht des Deutschen Wetterdienstes in Offenbach während der Nacht am Rhein. Westlich des Flusses, im Ruhrgebiet und bei Köln sei es frostfrei geblieben, während an allen anderen Meßstationen die Temperaturen unter null Grad fielen. Auch in der Nacht zum Samstag erwarten die Meteorologen wieder Frost östlich des Rheins.

BMW 3 B4b

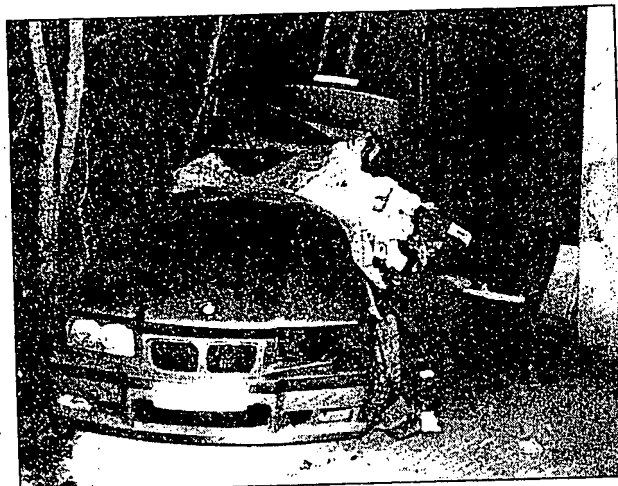
27.12.97

Todesfahrt am Heiligabend

Wiesbadener stirbt bei Verkehrsunfall / Gegen Brückenpfosten geprallt

hrj. WIESBADEN (Eig. Bericht) – Ein 41jähriger Autofahrer ist am Heiligabend bei einem Verkehrsunfall in Wiesbaden tödlich verletzt worden. Aus bislang unbekannter Ursache kam der Fahrer nach rechts von der Fahrbahn ab, fuhr über einen Gehweg und prallte seitlich gegen die Pfosten einer Schilderbrücke. Der 41jährige Wiesbadener erlag noch am Unfallort seinen schweren Kopfverletzungen.

Feuerwehrleute bargen die Leiche aus dem Autowrack. Die 34jährige Beifahrerin und ein neun Jahre alter Junge erlitten einen schweren Schock und wurden in ein Wiesbadener Krankenhaus gebracht. Der entstandene Sachschaden: 70000 Mark.



Das Wrack des Unfallautos: Der Fahrer war von der Straß abgekommen und gegen einen Brückenpfosten geprallt. Bild: W

BMW 5 → B4a

B4

WK

Junges Mädchen starb nach schwerem Unfall

1/8/96

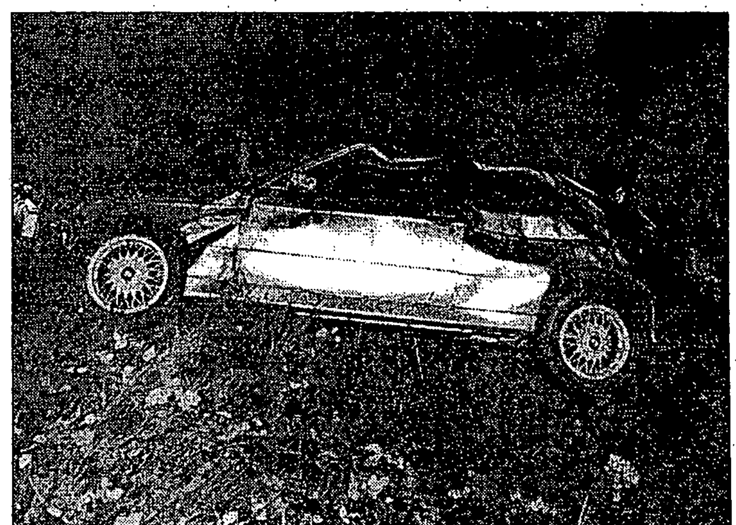
Auto raste gegen Baum und überschlug sich

BMW

lz. – Trauer, Bestürzung, Betroffenheit – das waren die Reaktionen gestern in Wiesbaden auf einen folgenschweren Verkehrsunfall, der am Abend zuvor ein Menschenleben und mehrere Verletzte gefordert hatte. Das Opfer: Ein vierzehn Jahre altes Mädchen, für das es keine Rettung mehr gab. Die Schülerin hatte zusammen mit drei jungen Männern im Alter von 16 und 17 Jahren im Auto gesessen, das ein 22jähriger Wiesbadener steuerte.

Auf der Klarenthaler Straße dann das Verhängnis: Der Fahrer, der nach Polizeiangaben mit stark überhöhter Geschwindigkeit gefahren ist, verliert die Kontrolle über den Wagen. Das Auto schleudert über die Fahrbahn, kracht gegen einen Baum, überschlägt sich mehrfach, kommt erst an einem Grundstückszaun wieder auf die Räder. Alle vier Mitfahrer, die nicht angeschnallt sind, werden aus dem Fahrzeug herausgeschleudert. Das junge Mädchen fällt aufs Dach eines Glasgewächshauses, bricht durch die Scheiben, bleibt leblos auf einem Tisch liegen. Notarzt und Rettungssanitäter können nichts mehr tun. Die Vierzehnjährige stirbt noch an der Unfallstelle. Der Fahrer selbst hat sich Knochenbrüche zugezogen, wird mit einem der Mitfahrer stationär ins Krankenhaus eingeliefert. Zwei andere junge Männer kommen mit leichteren Verletzungen davon, werden ambulant behandelt.

Noch lange nach dem Unfall sind Polizei, Feuerwehr und Technisches Hilfswerk im Rettungs- und Bergungseinsatz. Die Klarenthaler Straße wird vier Stunden lang voll gesperrt. Am Straßenrand ein Pfarrer im stillen Gebet...



Nur noch Schrottwert: Das Auto, mit dem die jungen Leute auf der Klarenthaler Straße verunglückten. Bild: WT

Unfallbericht des PM Schuy vom 40/01/94-13/3y.

27.11.94 gegen 1.10 Uhr auf einer langgezogenen Linkskurve der A3 oberhalb von Idstein

B5

Besichtigung am 28.11.94 um 10 Uhr :

VW VR6 , ca 7500 km	Frankfurt - Köln	als UNFALLWAGEN
VW VR6	Köln - Frankfurt	
MB Sportwagen 500 SL	Köln - Frankfurt	

VW VR6

Unfallbericht in Seite 2 und 3 des neu verfaßten Kap. Beschreibung.

Photo 1

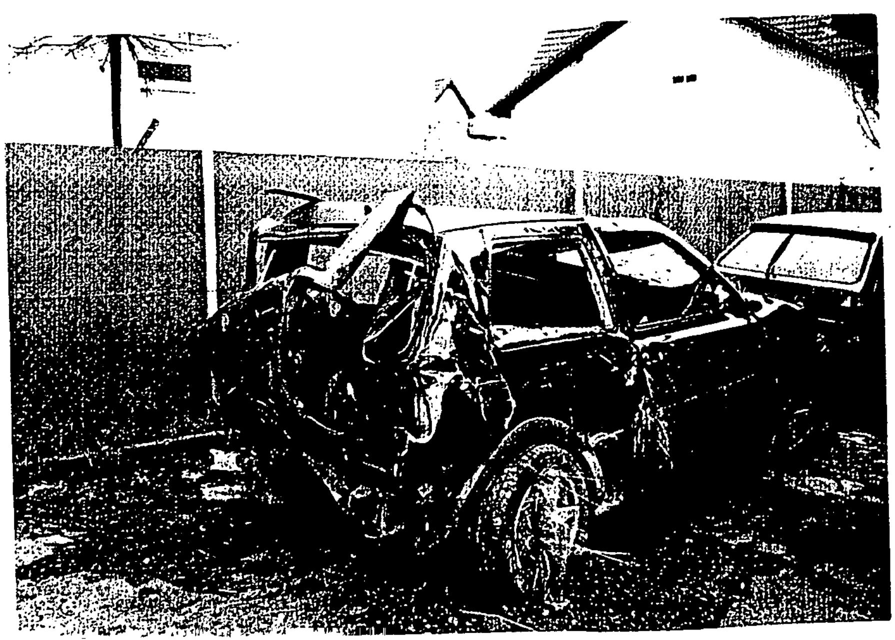
Dem Eindringen der total deformierten Insassenzelle infolge der genügend vorhandenen Restaufprallenergie wären die Insassen im Falle "nicht herausgeschleudert zu sein" hilflos ausgeliefert, mit Todes- und Verletzungsfolgen. Siehe Forderung in Abs. U3 in Seite 3

Photo 2

Wie das Gras von der Beifahrertür und der B-Säule *fest* geklemmt ist, deutet auf das Öffnen und Schließen der Türen während des mehrmaligen Überschlagens hin. Durch das Drillknicken was und ist die Hecktür offen geblieben. Siehe Forderung in Abs. U2 in Seite 3

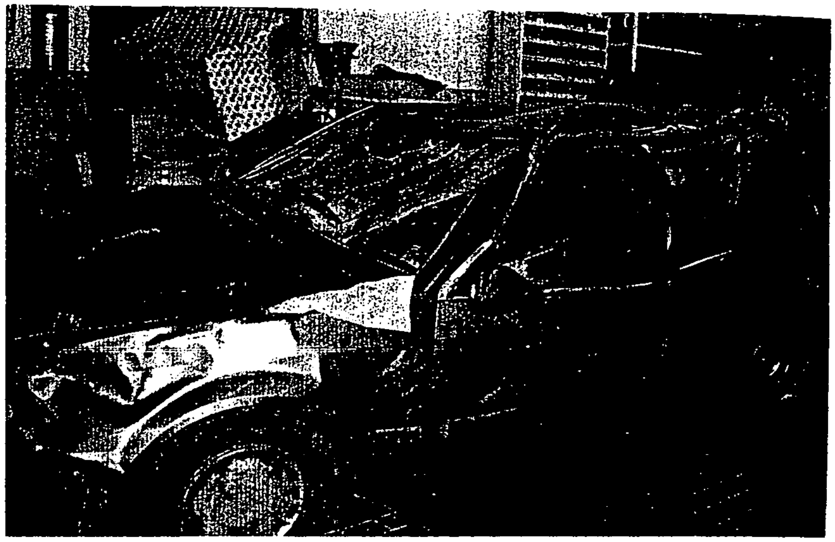
SEITEN KOLLISION + ÜBERSCHLAGEN

SIDE COLLISION + ROLLOVER



Ford. B6

Baujahr 1984 auf dem Heck des Ford (1) Escort aus dem Baujahr 1993 auf der Autobahn Köln Frankfurt am 2 Feb. 95.



2

Trotz der starken Deformation des Heckbaues oder Kofferraumes war die fahrerseitige Fahrzeugseite des Ford (1) der Restenergie entsprechend den Lastfällen nach Abs. 8a-8d ausgesetzt. Während des Überschlagens wurde der Fahrer herausgeschleudert, wie alle vier Insassen des VW VR6 beim Unfall am 27.11.94 in S.2-4.

Lösungen: Verbundkonstruktion nach Abs. A6 in S.26-28 sowie Abs. A5a in S.23-25 gegen das Versagen der Türschlösser.

14

Genauso wie beim VW VR6 wurde das Dach des Ford (2) nach dem Überschlagen deformiert.

Lösung: zweifache Verbundkonstruktion nach Abs. A6 und A7 in S.28-31.

WK 02.02.95

Fahrer starb auf der A 3

VoS. IDSTEIN / BAD CAMBERG — Ein 24jähriger Autofahrer starb bei einem Unfall auf der Autobahn A 3 am Donnerstagabend gegen 23. 30 Uhr zwischen Idstein und Bad Camberg. Ein zweiter 26jähriger Fahrzeuglenker aus Hofheim wurde bei diesem Unfall leicht verletzt. Den Gesamtsachschaden schätzt die Idsteiner Autobahnpolizei auf rund 21 000 Mark. Der Unfall ereignete sich auf der Fahrspur Richtung Frankfurt in Höhe des „Wörsdorfer Loches". Dort kam der 24jährige von der linken Fahrspur auf die mittlere und rammte dabei das dort fahrende Auto des 26jährigen Hofheimers. Beide Fahrzeuge kamen ins Schleudern, rasten rechts in die Böschung, überschlugen sich mehrfach und blieben nach 70 Metern in der Böschung liegen. Durch die Wucht des Aufpralls wurde der 24jährige aus dem Wagen geschleudert und blieb etwa zehn Meter von seinem Wagen

20

B7

VW Golf III

Idsteiner Zeitung : 30.04.1997

Kreis

Für die Fahrerin dieses Autos kam jede Hilfe zu spät. Sie war gestern vormittag zwischen Görsroth und Niederauroff gegen ein entgegenkommendes Fahrzeug gerutscht. Feuerwehrleute mußte die eingeklemmten Unfallopfer aus dem Autowrack befreien. Bild: Erwin John

21jährige schleudert in den Tod

Schwerer Verkehrsunfall zwischen Görsroth und Niederauroff / Straße gesperrt

ski. RHEINGAU-TAUNUS-KREIS – Ein Todesopfer und zwei Schwerverletzte forderte ein Verkehrsunfall, der sich gestern Vormittag gegen 10.20 Uhr zwischen Görsroth und Niederauroff ereignete: Eine 21jährige Frau aus Kaltenholzhausen im Rhein-Lahn-Kreis starb in den Trümmern ihres Autos.

Die 21jährige war mit ihrem Golf auf der L 3274 in Richtung des Idsteiner Stadtteils Niederauroff unterwegs. In einer Rechtskurve geriet sie auf regennasser Fahrbahn auf die linke Seite der Straße. Nach Polizeiangaben war sie vermutlich zu schnell unterwegs.

Der Golf der jungen Frau schleuderte und prallte mit der Fahrerseite gegen einen entgegenkommenden Passat. Die 21jährige und ihr 22jähriger Beifahrer aus Eltville wurden im Fahrzeug eingeklemmt und mußten von Feuerwehrleuten befreit werden. Die Fahrerin starb noch an der Unfallstelle, der Beifahrer wurde mit einem Rettungshubschrauber in ein Frankfurter Krankenhaus geflogen.

Der entgegenkommende Passat wurde von einer 34jährigen Frau aus Görsroth gelenkt. Sie wurde schwer verletzt. Mit im Auto war außerdem ihre 4jährige Tochter, die allerdings nur leichte Verletzungen erlitt. Beide wurden in ein Wiesbadener Krankenhaus gebracht.

Die Landesstraße mußte für die Bergung der Unfallopfer und die Beseitigung der Autowracks über zwei Stunden gesperrt werden. Der Sachschaden beträgt nach Polizeiangaben rund 12 000 Mark.

WT 2.1.97

Kollission in der Kurve

Wörsdorferin starb bei Unfall auf der B 275 in der Silvesternacht

t. IDSTEIN - Eine 27jährige au aus Wörsdorf kam in der lvesternacht bei einem auenvollen Verkehrsunfall f der B 275 zwischen Idstein d Esch ums Leben.

Der schwere Unfall ereignete h gegen 21.20 Uhr kurz hinder Abfahrt Bermbach in er Rechtskurve. Eine 43jähe Fahrerin aus Butzbach ge- t mit ihrem VW-Golf auf gennasser Fahrbahn ins Schleudern, weil sie, so vermutet die Polizei, mit nicht angepaßter Geschwindigkeit unterwegs war.

Der Golf kam auf die Gegenfahrbahn und stieß dort mit einem entgegenkommenden Ford Fiesta frontal zusammen. Dabei wurde die junge Wörsdorferin in ihrem Ford eingeklemmt und so schwer verletzt, daß sie noch an der Unfallstelle starb.

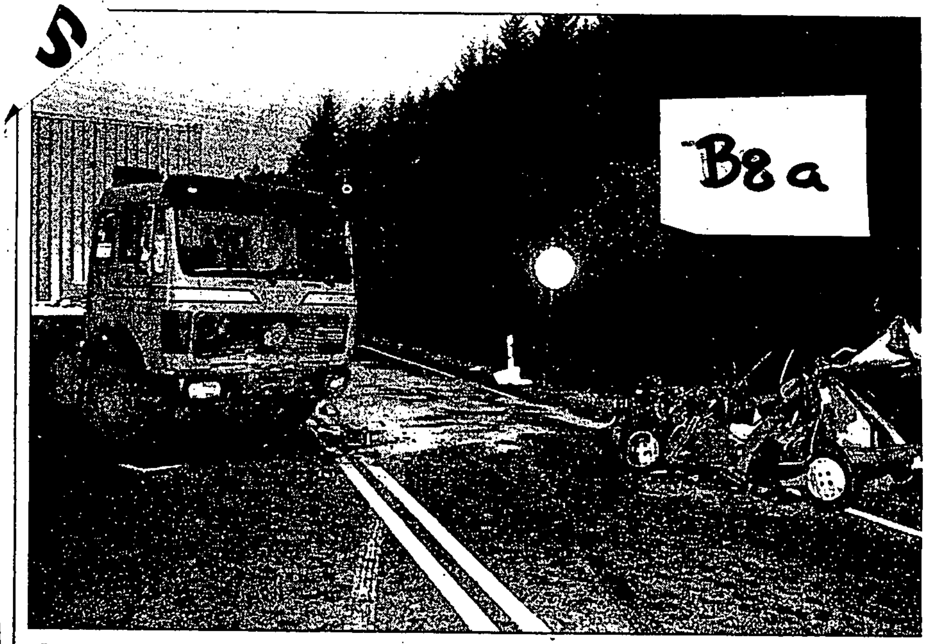
Die Frau aus Butzbach trug Kopfverletzungen und Prellungen davon und mußte zur Behandlung in ein Krankenhaus gebracht werden. Der Sachschaden summierte sich nach Auskunft der Polizei in Wiesbaden auf schätzungsweise 25 500 Mark.

Während der Unfallaufnahme mußte die Bundesstraße bis gegen 23.30 Uhr für den Verkehr voll gesperrt werden. Ein Sachverständiger nahm seine Arbeit auf.

ontal stießen die beiden Wagen zusammen. Eine 27jährige Frau aus Wörsdorf wurde in ihrem Ford esta (hinten) so schwer verletzt, daß sie nicht überlebte. Bild: wt

VW Golf / Ford Fiesta

MAIN PRESSE



Tödlich verletzt wurde eine 25jährige Frau aus Idstein, die mit ihrem Auto auf der B 417 frontal einen Lastwagen prallte. Bild

WT 24.10.97

Unfall fordert Todesopfer

25jährige Idsteinerin verunglückte auf der Platte / Unfallursache unkla

mäd. KREIS – Zu einem tödlichen Unfall kam es gestern morgen um 6.38 Uhr auf der B 417 zwischen Platte und Abfahrt Fischzucht.

Eine 25jährige Frau aus Idstein fuhr mit dem kleinen Peugeot ihrer Schwester aus Richtung Neuhof nach Wiesbaden. Kurz vor der Abfahrt Fischzucht kam sie aus bislang unerfindlichen Gründen auf abschüssiger Strecke von ihrer Fahrspur so weit nach links ab, daß sie über beide Gegenspuren hinweg auf den gegenüberliegenden Grünstreifen geriet. Auf diesem fuhr sie 23 Meter weiter, touchierte dann die Leitplanke und wurde von dieser auf die Fahrbahn zurückgeworfen. Dort prallte der Peugeot frontal mit einem aus Wiesbaden kommenden Lastwagen zusammen. Der Fahrer des Lkw versuchte noch vergeblich, dem Hindernis auszuweichen.

Die junge Frau wurde so schwer verletzt, daß sie noch an der Unfallstelle verstarb. Der rasche Einsatz der Wiesbadener Berufsfeuerwehr, die mit 13 Einsatzkräften vor Ort war, kam zu spät. Es dauerte 30 Minuten, bis die Fahrerin mit Hilfe von hydraulischem Rettungsgerät aus dem total zerstörten Personenwagen bef werden konnte. Der Fahrer Lkw wurde glücklicherw nur leicht verletzt. Insges ist ein Sachschaden in H von 30 000 Mark entstande

Über die Unfallursache selt die Polizei bislang. Wet bedingte Gründe kän höchstwahrscheinlich nich Betracht, hieß es in einer ers Stellungnahme.

Zur Bergung der verunglü ten Fahrerin und z laufnahme mußte die mehr als zwei Stun plett gesperrt werd zeuge wurden auf umgeleitet.

Peugeot / LKW

Zwei Tote und zwei Verletzte

Schwerer Verkehrsunfall

Zwei Zivilamerikaner sind in der Nacht zum Freitag auf der Nordumgehung Bergen in den Tod gefahren. Ihr Personenwagen kollidierte gegen 4.30 Uhr mit einem entkommenden Kleintransporter, dessen Fahrerin lebensgefährlich verletzt wurde. Die Beifahrerin liegt ebenfalls im Krankenhaus, ihr Gesundheitszustand wird jedoch nicht als kritisch angesehen. An den beiden Unfallautos ist ein Schaden von 40 000 Mark entstanden.

Die beiden 27jährigen Amerikaner, beide wohnten in Bergen-Enkheim, waren zur Unfallzeit auf dem Weg in Richtung Maintal. An einer übersichtlichen Stelle und bei trockener Fahrbahn geriet der blaue Honda Civic LX kurz vor der Begegnung mit einem türkisfarbenen Mercedes Transporter vom Typ 208 D auf die linke Spur. Die beiden Fahrzeuge prallten frontal aufeinander, wobei der Motorraum des Honda beinahe bis zur Windschutzscheibe zusammengepreßt wurde. Für die beiden Insassen, die nach den Feststellungen der Polizei nicht angegurtet waren, kam jede Hilfe zu spät.

Die 32jährige Fahrerin des Transporters wurde mit schweren Verletzungen in das Hanauer Stadtkrankenhaus eingeliefert. Die 53jährige Beifahrerin ist vom Notarztwagen des Unfallkrankenhaus in lebensbedrohendem Zustand zur Uniklinik gefahren worden. Die beiden Frauen waren für eine Gärtnerei aus Langenselbold zur Blumenmarkthalle in der Nähe der Friedberger Warte unterwegs.

„Wir haben weder Brems- noch Schleuderspuren feststellen können", sagte Hans-Jürgen Voigtsberger, Sachbearbeiter beim 20. Revier, zum Ergebnis der Unfallaufnahme. Der Beamte hält es für denkbar, daß der folgenschwere Zusammenstoß auf Alkoholkonsum zurückzuführen ist. In dem Honda habe es nach Alkohol gerochen. In dem Fahrzeug hätten Bierdosen gelegen.

Nach Auskunft seines Kollegen war die Nordumfahrung früher einmal eine „Rennstrecke". Durch eine Geschwindigkeitsbeschränkung auf 80 km/h und eine Überholverbotsstrecke sei die Situation jedoch entschärft worden. „In den 15 Jahren, die ich beim 20. Revier bin, war das der erste tödliche Unfall auf dieser Straße", erinnerte sich der Beamte.

Die Totalsperrung auf der Nordumgehung wurde erst gegen 7.50 Uhr aufgehoben. Bis dahin ist der Berufsverkehr über die Erlenseer Straße durch den Bergener Ortskern umgeleitet worden. habe

Frontalzusammenstoß auf der Nordumfahrung Bergen. In dem Personenwagen starben zwei Menschen.
(FR-Bild: Jochen Günther)

B 9

Chrysler muß 262,5 Millionen Dollar zahlen

D 10

B10b

Urteil eines Geschworenengerichts / Autokonzern kündigt Berufung an

Chrysler Corp., Auburn Hills (Michigan). Amerikas drittgrößter Auto-Konzern ist von einem Geschworenengericht in South Carolina zu Schmerzensgeld und einer Geldbuße von insgesamt 262,5 Millionen Dollar, rund 460 Millionen DM, verurteilt worden. Nach Angaben von Fachleuten ist dies das höchste Bußgeld, das je gegen einen Auto-Konzern verhängt worden ist. Chrysler hat gegen das Urteil Berufung angekündigt. Erfahrungsgemäß werden die hohen Geldbußen, die Geschworenengerichte verhängen, in den höheren Instanzen oft deutlich vermindert. Häufig einigen sich die Parteien dann auch auf einen außergerichtlichen Vergleich, wobei die Zahlung geheimgehalten wird.

In dem Prozeß ging es um die Verantwortung für den Tod eines sechsjährigen Jungen, der 1994 bei einem Unfall aus einem Chrysler-Minivan geschleudert worden war. Die Kläger hatten Chrysler die Verantwortung angelastet. Denn Chrysler habe wider besseres Wissen versäumt, ein unzulänglich konstruiertes Schloß in der Hecktür zu verbessern. So habe sich diese Hecktür – wie bei mehreren anderen Unfällen – geöffnet; der Junge habe deshalb ins Freie geschleudert werden können. Chrysler hatte argumentiert, daß der Fahrer des Minivans den Unfall durch Überfahren eines Rotlichts verursacht habe. Der Junge, der nicht angeschnallt gewesen sei, sei nicht durch die Hecktür, sondern ein Seitenfenster nach außen geschleudert worden.

Die Kläger haben darauf hingewiesen, daß Unfälle, bei denen sich die Hecktüre geöffnet habe, in den vergangenen Jahren für mindestens 37 Todesfälle verantwortlich seien. Dennoch habe Chrysler jahrelang in Washington alle Hebel in Bewegung gesetzt, um an einem Rückruf der Autos und einem Austauschen der seit 1985 verwendeten Schlösser vorbeizukommen. Die Geschworenen sprachen den Eltern des Opfers 12,5 Millionen Dollar Schadenersatz sowie die Geldbuße von 250 Millionen Dollar, umgerechnet 432,5 Millionen DM, zu.

Amerikanische Geschworene verhängen oft exorbitant erscheinende Geldbußen. Ziel ist dabei, daß die Bußen auch Großkonzerne wie Chrysler empfindlich am Geldbeutel treffen sollen. Die potentiell hohen Geldbußen wiederum locken Rechtsanwälte an, Kläger selbst in äußerst schwierigen und aufwendigen Verfahren zu vertreten. Denn in Amerika ist es üblich, die Rechtsanwälte mit einem Drittel oder mehr an den erstrittenen Zahlungen zu beteiligen. Wie es heißt, sind mehrere weitere Klagen mit ähnlichen Vorwürfen gegen Chrysler anhängig oder geplant. Seit dem Modell-Jahrgang 1996 verwendet Chrysler in seinen Minivans andere Schlösser.

FAZ. 16.10.97 AKD.9.10

B10a

Volvo

Bei Auffahrunfall an Airbag verletzt

ROTTERDAM/HAMBURG (dp – Eine niederländische Autofahrerin ist bei einem Auffahrunfall Rotterdam offenbar durch einen Airbag verletzt worden. Nach Angabe der Polizei erlitt sie an Kinn, Ha und Armen „Verbrennungen erste und zweiten Grades". Ein Polizesprecher kündigte gestern eine genaue Untersuchung des Vorfalls zusammen mit dem Autohersteller Volvo und dem niederländischen Gerichtslaboratorium an.

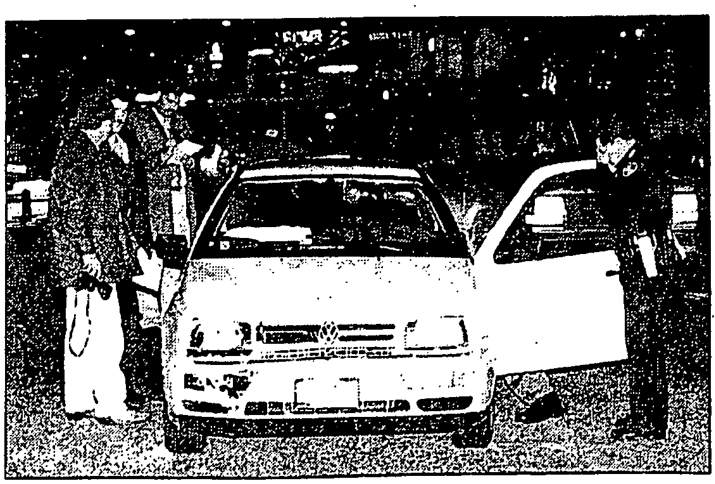
WK 14.7.95

B10c

Baby von einem Airbag geköpft

Grauenvolles Ende eines Bagatell-Unfalls / Kindersitz war nicht angeschnallt

BOISE (AP) Eine wahre Flut von Anrufen besorgter Eltern ist über die US-Verkehrsbehörden hereingebrochen, nachdem ein Baby bei einem eigentlich geringfügigen Auffahrunfall von einem Airbag enthauptet wurde. Eine gerichtliche Untersuchung ergab jetzt, daß der Kindersitz nicht auf dem Vordersitz festgeschnallt war. Die Mutter des Kindes war auf einem Parkplatz in Boise im US-Staat Idaho mit ihrem VW-Jetta beim Rückwärtsfahren auf ein anderes Auto geprallt. Dabei löste sich der Beifahrer-Airbag, riß den Kopf des einjährigen Mädchens ab und schleuderte ihn durch das zerbrochene Autofenster auf den Parkplatz.



In diesem VW-Jetta wurde nach einem geringfügigen Zusammenstoß ein Baby von einem Airbag geköpft. Der Kindersitz des kleinen Mädchens war nicht angeschnallt. Unser Bild zeigt Beamte bei der Spurensicherung. Foto: AP

Auch bei VW haben zahlreiche besorgte Autofahrer angerufen: „Die Leute wollen wissen, wie sie ihren Airbag wieder abklemmen können, sagte ein VW-Sprecher. Der Unfall hat die Diskussion über den Nutzen der Airbags wieder neu angeheizt. „Die Eltern sind entsetzt, daß eine Mutter, die ihr Kind schützen wollte, in einen solch schrecklichen Unfall verwickelt wurde", berichtete Nancy Rush vom Gesundheitsamt in Boise. Ohne den Airbag, so Polizeisprecher Tim Rosenvall, wäre das „nur ein kleiner Verkehrsunfall" gewesen. In den USA werden Airbags für den Tod von 31 Kindern und 20 Erwachsenen – zumeist kleineren Frauen – verantwortlich gemacht.

Das gerichtsmedizinische Gutachten könnte der neu entfachten Diskussion wieder die Spitze nehmen. Ein wesentlicher Faktor für den schrecklichen Ausgang des Unfalls sei gewesen, daß der Kindersitz nicht auf dem Beifahrersitz befestigt gewesen sei, erklärte Erwin Sonnenberg. Schon seit längerem wird in den USA diskutiert, ob es nicht grundsätzlich verboten werden sollte, Kinder auf dem Vordersitz zu befördern.

Frankfurter Rundschau

dschau

AUS ALLER WELT

PILE UP

FR 28.09.98

Mehrere Tote und viele Verletzte bei Massenkarambolage

Zu schnelles Fahren bei Nebel Ursache für schweren Unfall

ch die Autobahn bei Ulm, weil zahllose Autofahrer bei Nebel zu schnell gefahren sind. (Bild: Heckmann/ap)

Bei der ersten schweren Massenkarambolage im dichten Herbstnebel sind am Wochenende auf der Autobahn Stuttgart-München bei Ulm vier Menschen ums Leben gekommen. Von den rund 50 Verletzten schwebten nach Polizeiangaben am Sonntag noch einige in Lebensgefahr.

ULM, 27. September (dpa)/ap). In den Unfall waren fast 100 Fahrzeuge verwikkelt, darunter drei Autobusse und ein Tanklastzug. Die A 8 glich über Hunderte Meter einem Trümmerfeld. Eine Nebelwarnanlage war wegen Wartungsarbeiten ausgeschaltet. Auch Finanzminister Theo Waigel steckte in dem Stau, stieg aus und tröstete Verletzte.

Die Unfallserie auf der Albhochfläche begann, als bei Sichtweiten von weniger als 50 Metern ein Busfahrer nicht rechtzeitig bremsen konnte, nachdem ein Pkw vor ihm gestoppt hatte. Der Bus hielt offenbar keinen Sicherheitsabstand. Der Pkw geriet in Brand, beide Insassen kamen in den Flammen um. Dann fuhr auf den verunglückten Bus ein zweiter auf, und immer mehr Autos rasten in die Unglücksstelle. Rettungskräfte sprachen von einem unverantwortlichen Verhalten vc Autofahrern, die teilweise die zum Ui glücksort fahrenden Rettungswagen i Nebel mit hohem Tempo überholt hätten.

Warum auch auf der Gegenfahrbahn : Richtung Stuttgart bei fünf Unfällen : Fahrzeuge ineinanderkrachten, war b zum Sonntag noch ungeklärt. Offenb: war Schaulust eine Ursache. Rettung hubschrauber konnten wegen des stark Nebels nicht landen. Schaulustige hatte sich um die Trümmer versammelt und b hinderten die Rettungsarbeiten.

Unter den Toten waren nach Mitteilu der Autobahnpolizei Mühlhausen drei 4 53 und 68 Jahre alte Männer und eine Jahre alte Frau. Über ihre Herkunft g die Polizei keine Auskunft.

Die vor sechs Jahren eingerichtete N belwarnanlage wurde vor knapp dr Wochen wegen dringender Verbess rungsarbeiten abgeschaltet. Ein Sprech des baden-württembergischen Verkeh ministeriums erläuterte, die Arbeiten s en bewußt nach der Hauptreisezeit u vor Beginn der schlechten Witterung b gonnen worden.

B 11

en für Lkw
ch erhöht

Urologie

Kassen sollen Kosten für Potenzpille übernehmen

Hurrikan bedroht New Orleans

Hunderttausende flüchten vor dem Wirbelsturm

MIAMI, 27. September (dpa/afp). Der ... Am Freitag hatte „Georges“, der vierte

Verständigung

Sprachschützer mit Erfolg gegen Verhunzer

MÜNSTER, 27. September (dpa). E

Niño in Rheinhessen?

lsturm auf A 63 sorgt für Diskussionsstoff

**erhängnisvolle Sand-
ler am Mittwoch auf
3 bei Wörrstadt zu
Massenkarambolage
könnte auf außerge-
he Trockenheit und
umlose Landschaft
ssens zurückzufüh-**

iserem
tionsmitglied
s Metz

STADT – Seit ein
m mit Geschwindig-
is zu 70 Kilometern
einhessen fegte, die A
chen Wörrstadt und
eim unter sich begrub
Autos bei Sichtweite
inander rasten, ist für
chultz alles möglich:
tzt ein U-Boot auf der
n in dichtem Regen
t, würde mich das
cht mehr wundern."
er der Autobahnpoli-
n dem „Jahrhundert-
in seinem Revier
z aufgewühlt.
Haar wäre die Kata-
vermieden worden:
inen kleineren Unfall
ir bereits alarmiert",
chultz. „Wir wollten
gnalanhänger zur Ge-
gkeitsreduzierung
ken, da kamen von
ie Anrufe: Es knallt, es
ilfe, Hilfe."
neun Stunden Sper-
nte die A 63 erst gegen
r wieder freigegeben
Zuvor hatten zwei
erfer den Sand von
aße gespritzt. Die
ifen Autos kamen auf
mmelplatz in Wörr-
ultz geht von 200 000
haden aus. Die Ab-
hat federführend ei-
Versicherung über-

Die Autobahn ein Schlachtfeld: 26 Autos hatten sich ineinander verkeilt. Bild: Schmitz

nommen. Der Polizist hält es für möglich, daß bis zu 50 Prozent der Schadenssumme an den Autofahrern hängenbleiben.

Für das rheinhessische Wüstenphänomen haben die Polizisten ihre eigene Theorie: „El Niño hat bei uns zugeschlagen." Dieses, nach dem Christkind getaufte Wetterphänomen, treibt sonst nur in südlicheren Gefilden sein Unwesen.

Wetterexperten sehen denn auch keine Zusammenhänge. Stürme von dieser Stärke gebe es im Frühjahr häufig. Außergewöhnlich sei allenfalls die große Trockenheit gewesen.

Jürgen Reineke von Meteo Consult in Ingelheim tippt auf einen Wirbel. „Diese sind sehr austauscharm. Was einmal darin ist, kommt schwer wieder heraus." Verwirbelungen könnten an einem Haus oder an einer großen Hecke entstehen. Derartige Auswirkungen kämen vielleicht alle 10 Jahre einmal vor.

Ernst Zunke vom Deutschen Wetterdienst in Geisenheim weist darauf hin, daß im kahlen Rheinhessen die Stürme nahezu ungebremst über die Felder toben und lockere Ackerkrume abtragen könnten. Die Hecke an der Autobahn habe dann den Sandsturm verwirbelt, und zum Abladen seiner Fracht gezwungen. Für den Bund für Umwelt und Naturschutz (BUND) ist der Wüstensturm eine dringende Warnung, „daß die Landschaft Rheinhessens eine weitere Ausräumung nicht verträgt".

WT 9.8 9 5.3.98 D12

Massenkarambolage im Staubsturm: 22 Autos rasen aufeinander

Ein Orkan mit Spitzengeschwindigkeiten von 125 Stundenkilometern fegte gestern über Deutschland hinweg und richtete schwere Schäden an. Auf der Autobahn Mainz–Alzey führten die heftigen Sturmböen zu einem Massenunfall. Weil der Wind trockene Erde hochwirbelte und damit die Sicht auf die Fahrbahn stark einschränkte, fuhren insgesamt 22 Autos aufeinander. Elf Menschen wurden verletzt, drei davon schwer. Die Sichtweite hatte vorübergehend weniger als zehn Meter betragen. Die Unfallstelle zwischen Wörrstadt und Biebelnheim glich einem Autofriedhof.
Panorama und Region/Bild: Axel Schmitz

Pick up

C1

Dr. -Ing. Giok Djien Go

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Germany
Phone +49 6126 8949
Fax +49 6126 52614 at Ra. Wolf
letpat6\ntsb

Mr Ron Schleede and Mr Tom Haueter
National Transportation Safety Board
Washington, DC 20594
USA

my registered letter of 17/02/98 and pending patent DE 197 49 780 to resolve yaw-acceleration and large energy related to increasing speed and payload

Dear Mr Schleede and Mr Haueter,

Specs of SAE AS 8049 and JAR 25.561 to 785 to insufficiently ensure survival chance in the event of landing crash and turbulence-related accident are the theses I reported to FAA, JAA, other Governmental Administrations, aeroplane manufacturers and carriers world-wide by disclosing my inventions DE 197 49 780 to resolve the problem cases G1 to G7 of restraint systems thus enhancing and ensuring survival chance.
Please review the enclosure forwarded to FAA and JAA, to which I supplement

1) Standard safety belt of aeroplane must sustain loads imposed on passenger in Fig. 3 of DE 197 49 780 because the specified energy-absorbing rest is incapable to absorb energy ref. to Chap. II of the enclosure, so the passenger himself serves as energy absorber! This is one of the principle objections listed therein.
2) My other objections are due to the testing procedure which idealizes neither the turbulence-related accident nor landing crash. Compare please with testing procedures of car crash tests.
3) The payload of Boeing 747 of 356 tonnes and the initial landing speed of 235 km/h should be taken into account of amending *new* injury-related threshold values. The value of 1000 HIC at low speed of 48.3 km/h in a *very modest* dynamic test is exceeded in real accident, thus decapitating passengers.

I may express my concern of the coming victims, wherein we ourselves and/or our relatives could be found, due to

increasing number of severe/fatal injuries, flights, aeroplanes and landing crashes, turbulence-related accidents in the next decade.

You would agree with my opinion:

"Turbulence-related accident or landing crash causes in great extent severe/fatal injuries".
This is an evidence for the absolutely insufficient specs and the need to review.

The responsible feeling towards passengers drove me to have reported the failure of survival chance due to obsolete specs to Mr Ralph Nader of Consumer Advocate Centre. Please contact him in order to arrange a meeting with representatives from FAA, JAA; CAA, carriers, aviation industry whereat I would present my knowledge gained by evaluating injuries in car real front-, side-, real collision and/or rollover, thus enabling me to have completed eleven patent docs and -applics.

Aeroplane accident is properly idealized by car front-, side collision and/or rollover.

Thank you in advance for your interest.

kind regards

Go Giok Djien

Dr. Go

Attached: letter to FAA ...

C2

Dr.- Ing. Giok Djien Go

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letpat6\jaa-faa

JAA HQ
Saturnstraat 8-10
NL-2130 KA Hoofddorp
Holland

my pending patent DE 197 49 780 and registered letter of 11/03/98 disclosing the inadequate SAE AS 8049

Dear Sirs,

Survival chance in the event of landing crash and turbulence-related accidents is insufficiently ensured by the following specs of SAE AS 8049 and JAR 25.561 to 25.785:

I. In the dynamic seat-test at 38.4/48.3 km/h ref. to JAR 25.562 the specs for 1000 HIC, tension- and compressive loads (seat-belt forces) of 7938 and 6804 N as well as femur load of 10206 N should be lowered to at least the test data of MB (Mercedes Benz) 320 in a 50 % Offset crash test at 55 km/h listed in attached A.
   - Despite the very low 229/269 HIC the driver and co-driver were dead in the event of front collision and rollover resembling a turbulence-related accident.
   - The biomechanical experts of the University in Heidelberg expressed the concern of rib fractures due to the AUDI A6 seat-belt forces at 6900/8400 N. Upon exceeding the threshold value of belt at approx. 10000 N "restrained" passengers are catapulted by the remaining inertia force. See ejection of Mr Dressler in A.
   - Concern of leg fracture due to femur load over 10000 N should be raised.

   Photos and accident reports of this MB 320 and other cars are in my possession.

II. During the *forward motion* of passenger in the event of aeroplane accident the energy can be absorbed by the energy absorbers of DE 197 49 780, but not by energy absorbing rest ref. to 25.785 (d). See oscillating torso in B, problem cases G6 and failure of energy absorbing rests.

III. The small roll-, yaw angle $\pm 10^0$ and downward speed of 38.4 km/h and forward speed of 48.3 km/h ref to JAR 25.562 (b1 and b2) don't correspond to the following real data:
   - The yaw angles of 40^0 and 80^0 of VW Golf IV in the 50 % Offset- and NCAP crash tests are far larger.
   - Regarding the Boeing 747 of United Airlines en route from Tokyo to Hawaii the height-loss of 300 m within ms was larger than the downward speed, thus resulting in 110 minor/heavy and one fatal injuries.

IV. The increase of load/weight, speed and the valid specs in car industry make SAE AS 8049 legislated July 1990 and JAR 25 legislated March 1993 really obsolete:
   - Within three years the EU Commission has legislated specs, which are becoming tougher and tougher, for three front crash tests EU I, EU II and NCAP to enhance survival chance.
   - After five-year lapse the loads of VW Golf IV are substantially less than VW Golf III, e.g. from 760/590 to 422/311 HIC in contrary to 1000 HIC valid since 1990!
   - There are no specs for chest-, pelvis acceleration, lateral accelerations and yaw acceleration which is the most life-threatening (lethal) among all accelerations.

Please amend the specs with regard to problem cases G1 and G7 mentioned in DE 197 49 780 and inform me.

Thank you in advance for your interest.

Sincerely,

Go Giok Djien

Dr. Go

Attached A and B

Deutsche Post AG 65510 Idstein 1
00 4503 9909 60E E Int
8865I029 2060 12.03.98 09:47
ggf. Identnummer einkleben, Tagesstempel anbringen, unterschreiben

...rvice-Telefon
...29 06 90
...-Freitag, 09.00–18.00 Uhr

...des Kunden
...hlen Ihnen, nachstehende Felder auszufüllen bzw. anzukreuzen:
...fänger, PLZ, Bestimmungsort oder andere kundenbezogene Angaben:

Mr Jardin
FAA
1601 Lind Ave SW
Renton, Washington DC 98055/4056

Hinweise auf der Rückseite!

...inwurf-...inschreiben ☐ Übergabe-Einschreiben ☐ Eigenhändig
☐ Rückschein
☐ Nachnahme ☐ Eilzustellung
...ahmebetrag in DM

Dr.- Ing. Giok Djien Go

Registered

Mr Jeff Gardlin
FAA Crash Test
1601 Lind Ave. South West
Renton, Washington DC 98055/

SAE AS 8049
DE 197 49 780 disclosing my inventions to resolve the problem cases G1 to G7 in the event of aeroplane accident

C3

Dear Mr Gardlin,

I am proprietor of three German Patents DE 19615785 C1, DE 19636167 C1, DE 19711392 C1, several PCT- and German, US, EP- and Canadian Patent Applications, each of which with a high number of claims, in order to ensure, enhance survival chance and increase stiffness of seat, passenger compartment as well as cut costs etc.

On Canadian TLC Television of 25 Nov. 97 I closely watched the report of Mr Schleede and Mr Haueter of NTSB regarding severe/fatal injuries due to aeroplane- and turbulence-related accidents. Violent turbulence imparts force and vibration to aeroplane as well as passengers in indeterminate direction, thus, resulting in

- 863 minor, 63 heavy and two fatal injuries among 252 incidents in USA between 1981 to 1996 reported to FAA and
- 110 minor/heavy and one fatal injuries of the Boeing 747 of United Airlines whilst losing height of 300 m en route from Tokyo to Hawaii.

Fatal injuries of all passengers are always resulted from any landing crash of aeroplane, A300-600 in Nagoya and recently A319 in Taipei.
This failure of lap belt serving as *standard* restraint system *for aeroplane* is substantiated by the following cases:

I. The test data of MB E200 *without airbag*, resembling an *airbagless* aeroplane, in the event of 50% offset front collision at the speed of 55 km/h in Table A1 are suited for the comparison with the following AS 8049 specifications, Fig. 6 and 7:

test speed	55 km/h	32.9 to 48.3 km/h
driver HIC	1486	1000 ref. to 5.3.9.3
seat belt force	8280/8380 N	7780 N ref. to 5.4.5

Seat belt force over 6000 N is responsible for cracking the ribs!

The test data of MB E200, particularly of Renault Espace, would be enormously larger, thus, fatally injuring and catapulting the occupants of aeroplane in exceed of failure limit of belt at 10000 N, if

1) the crash speed were set equal to landing speed of 235 km/h,
2) the collision would correspond to collision type U3 or U4 (see problem case G6 pp 5 and Fig. 7 of DE 197 49 780),
3) the total load were set equal to Boeing of 110 to 150 tonnes and
4) only lap belts were used. These belt, highly responsible for severe/fatal injuries in car collision during 1950s to 60s, has been replaced by the three-point safety belt of inventor Bohlin comprising a shoulder and lap safety belt to distribute the load to the *upper* and *lower* torso. The multi-point safety belts in Fig. 33 are further improvement over Bohlin's

II. The yaw-acceleration ref. to problem case G3, responsible for the difference between both HICs and head decelarations of driver and co-driver, is *far more life-threatening* than the longitudinal head acceleration and lateral accelerations in S6. See, G7, literature listed in pp. 33 and published by Institut für Fahrzeugsicherheit, Leopoldstr 20, 80802 München such as

- "Neck injuries to restrained children" Nr. 8906 and
- "Neck injuries in Car Accidents, Causes, Problems and Solutions" Nr. 8906. Despite the small the delta speed of 8.5 km/h in the sled test some volunteers suffered from minor injuries for two days. See A5 and S5. Greater delta speed in aeroplane accident would yield severe/fatal injuries.

III. The BMW-driver HIC of 266 is far lower than the AS 8049 limit of 1000. However, at the crash speed of approx. 80 km/h the rollover after front collision against a tree resulted in a greater range of oscillating accelerations, thus severely/fatally injuring *passengers*. The rollover of the MB E320, one of the world safest cars, yielded fatally injured *passengers*. Evidently, this AS limit at the speed 48 km/h is too low.

IV. The turbulence-related vibration imposed on restrained passengers is not idealized by the dynamic test governed by 14, 16, 18.4 and 30 g as well as yaw-, roll- and pitch angle 0 and $\pm 10^0$ ref. to Fig. 6, 7, 9A and 9B, respectively. These accelerations are assumed far lower than all those listed in A1 to A4, which would substantially larger on the increase of the landing speed of 235 km/h.

V. No specification of AS 8049 is found to limit loads imposed on any restrained passenger in load cases I to IV in Fig. 3. Femur force over 8000 N fractures legs! See Chap. I to X.

VI. No specification of AS 8049 is found to limit loads imposed on the children seat which is invented in G5 and Fig. 33.

AS 8049 issued **07/1990** is **obsolete** due to increasing payload and speed, particularly in comparison with specifications of EU- and US-front- and side crash tests. Within **three years** three EU- front crash tests have been issued, with the result, that the car manufacturers are complaining about the coming NCAP offset crash test. The latest model of VW Golf as well as dummies were rotated at the yaw angle of approx. 80^0 in the NCAP offset crash test (Auto Motor und Sport 23/97). I submitted to EU Commissioner Neil Kinnock my suggestion to limit the yaw-acceleration in order to reduce the annual road toll of 45000 fatal injuries and 1.6 million injuries totally costs DM 290 billions according to the EU "Promoting Road Safety in the EU" ISBN 92-78-18297-4.

For the purpose of ensuring and enhancing survival chance I would be grateful if you would
- introduce new specifications for restraint system, children seat in static- and dynamic test and
- deliver me your verdict on my inventions of how to gradually lower the great impact energy of crashing aeroplane.

I am available for presentation and discussion in your office HQ upon reimbursing my travel expenses. Should you have any questions please don't hesitate to phone me, preferably, in the morning.

Thank you in advance for your interest.

Sincerely,

Dr. Go

Attached:
Patent Application DE 197 49 780 according to USPTO
A1 to A5, S5 and S6
Passenger ejection from brandnew BMW and VW VR6, Decapitation of passengers in MB E320

AIR CANADA

Air Canada Centre
PO Box 9000
Saint-Laurent, Québec H4Y 1C2

Centre Air Canada
CP 9000
Saint-Laurent (Québec) H4Y 1C2

C4

May 5, 1998

Dr. Ing. Giok Djien Go
Pfahlgrabenstr. 45
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Germany

Dear Dr. Go,

Your two letters of March 1998 to our President & CEO have been referred to my office. I have read them with great interest and congratulate you for your efforts to address issues that are the subject of numerous industry committees, particularly SAE.

Air Canada, as an operator, purchases seats and seat belts which are certified by our suppliers. We do not have the engineering resources nor the mandate to deviate from industry standard.

Since you have acquired the patents to protect your design, I suggest you approach the seat vendors with your concept.

Thank you for thinking of Air Canada to implement your design. I shall watch with interest to see it appear in the industry.

Sincerely,

T. F. Chown
Chief Engineer, Interiors

TFC/ml

FCLT9804.DOC

DAIMLERBENZ
AKTIENGESELLSCHAFT

Daimler-Benz AG · 70546 Stuttgart

C6

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58 570	58 292	C106

Ihr Zeichen, Ihre Nachricht vom	Unser Zeichen, unsere Nachricht vom	Name	Datum
	FTP/P au-st	Herr Auer	5. Mär. 1998

Ihr Erfindungsangebot
Unser Zeichen: 18897

Sehr geehrter Herr Dr. Go,

besten Dank für Ihr an Herrn Schrempp gerichtetes Schreiben vom 17.02.1998.

Durch die Übermittlung Ihrer diversen Schutzrechte und Schutzrechtsanmeldungen (bezüglich der DE 196 15 785 C1 in Ihrem Schreiben muß es allerdings korrekt DE 196 15 985 C1 heißen), haben Sie uns einen interessanten Überblick hinsichtlich Ihres Schaffens auf dem Gebiet der Fahrzeugsicherheit gegeben. Dafür danken wir Ihnen sehr. Daß die von Ihnen beschrittenen Wege in eine die Sicherheit von Kraftwagen positiv beeinflussende Richtung gehen, haben Sie aus der Reaktion verschiedener Institutionen gewinnen können.

Auch wir arbeiten ständig intensiv daran, die Sicherheit unserer Fahrzeuge und damit auch die Sicherheit für die Fahrzeugbenutzer zu erhöhen. Dabei ist jedoch oberstes Gebot, daß die Sicherheitsvorkehrungen in das Fahrzeugkonzept passen und z.B. keine Minderung des von den Produkten unseres Hauses erwarteten Komforts nach sich ziehen. Ein weiteres, im Vordergrund stehendes Entwicklungsziel besteht darin, trotz Reduzierung des Fahrzeuggewichtes den Sicherheitsstandard zu erhöhen. Das bedingt, daß bereits vorhandene Fahrzeugstrukturen optimiert werden und auf zusätzliche, gewichtserhöhende Sicherheitseinbauten möglichst verzichtet wird.

SR Technics

C5

Verdict in German and English

Herr Dr. Ing. Giok Djien Go
Pfahlgrabenstrasse 45
D-65510 Idstein

SR Technics AG

Engineering Interiors TUEK

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2. April 1998
Patentschrift 197 49 780.2-22

Passenger Seat Restraint System

Sehr geehrter Herr Dr. Go

Im Auftrag unserer Geschäftsleitung bedanke ich mich für die Zustellung Ihrer interessanten Patentschrift.
Das fundiert dokumentierte Restraint System ist bestimmt als grosser Schritt Richtung 100% Sicherheit anzusehen, doch sind damit hohe Kosten und Abhängigkeiten verbunden.
Das beschriebene Restraint System ist im Vergleich zum heutigen Standard um Faktor 100 bis 200 teurer (die Sitzmodifikationen nicht eingerechnet) und macht sich zudem durch eine spürbare Gewichtszunahme bemerkbar.
Die Handhabung des Systems ist von den einzelnen Passagieren abhängig und kann nicht wirkungsvoll kontrolliert werden.
Verletzungen durch schwere Turbulenzen im Flug betreffen denn auch hauptsächlich jene Passagiere, welche nicht angeschnallt waren.

VERDICT

Swissair und SR Technics sehen ihre ständigen Bemühungen um die Sicherheit prioritär in der Unfallverhütung.
Verbesserungen der Ausrüstung von Passagiersitzen werden in Cabin Safety Working Groups innerhalb der FAA und der JAA erarbeitet und bezüglich Effektivität, Handhabung, Realisation und Unterhalt beurteilt und verabschiedet, um dann gegebenenfalls via Behördenanweisung in die Bauvorschriften aufgenommen zu werden.
Wir sind daher der Ansicht, dass Erfindungen wie die vorliegende in solche Gremien einfliessen sollten.

Freundliche Grüsse

SR Technics Engineering
Interiors and Cargo Loading Systems T U E K

Heinrich Schmid, Manager

Beilage

On behalf of Swissair Board of Directors SR Technics (C5), examining the pending patent from the evidences well decribed therein, viewed it as a great development towards 100 % **survival chance** (100 % Sicherheit), however in regard to the increase of costs by 100 to 200%, reviewed in Chap. 3.1, and manual operation, which cannot be controlled by the flight attendants/captain. Upon carefully evaluating the volumious doc, innovative belt-feeding devices automatically operating belts to belt or unbelt can be monitored, with the extended possibility from the cockpit. Daimler Benz's engineers/accident experts (C6) are aware of giving a verdict user-friendliness thereon.

Dr.- Ing. Giok Djien Go

Registered

Mr Director Brian O'Neill
IIHS
1005 N. Glebe Rd. Suite 800
Arlington, VA 22201

1) compability of two colliding cars having c
2) minimizing the most lethal force resulted f

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Arlington, VA 22201

Wichtige Hinweise auf der Rückseite!

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C7

Dear Mr O'Neill,

Ref. to your comparative test of nine vans published in the Spiegel (enclosure A) and the test of Opel Sintra carried by AMS (Auto Motor und Sport) published 15/97 I have introduced my inventions to Opel as well as to the GMIO President Louis Hughes since Feb. 97. Despite your critic to the failure of passenger protection of GM Trans Sport the state of deformation of the life-threatening Opel Sintra (B) verifies the unreliable survival chance, which is criticized by AMS 4/98 and Spiegel 25/97. After my presentation in Oct. 97 Opel IP (Intellectual Property) Dept. returned all my documents.
Owing my 3rd patent I restarted to offer my inventions by approaching a great number of car manufacturers. See C.. Daimler (Mercedes) Benz, issued a two-page letter of positive verdict and intention of use for the project if there is a need in the future, and Volvo is still investigating my inventions. Two car manufacturers enjoying an esteemed reputation world-wide on survival chance are interested of improving survival chance, but Opel IP Dept turned down again.
You would agree with my hypothesis concerning the most lethal force resulted from yaw-acceleration which is not legislated by NHSTA and EU-Commission receiving my letters of objection. Upon the collision of two cars (AUDI A8 and A3) having different weight (D) the passengers of A3 are subjected to forces resulted from longitudinal-, reverse- and yaw-acceleration. These problems can be resolved by the enclosed patents DE 19711392 C1, DE 19615985 C1 and DE 19636167 C1 as well as pending patent DE 19749780 which is recommended for use by Swissair, Air Canada and Lufthansa. I have forwarded to FAA, JAA and NHSB two letters of objection to the insufficient specs of SAE AS 8049 and JAR 25.561 to 25.785.
Enclosed you find the verdicts of Technical Vehicle Office, the German NHSTA working closely with NHSTA, German Road Security Administration to my several inventions. My four pending patents in German are not included. Each application is provided with a Chap "Summary of advantages" to give you the opportunity to make their own verdict.

Could you organize a presentation and discussion with NHSTA and American Car Industry in your office HQ in order to legislate new specs and enhance survival chance?
Should you have any question please don't hesitate to phone me, preferably, in the morning.

Thank you in advance for your interest.

kind regards

Dr. Go

Attached:
DE 19711392 C1 (PCT/DE98/00694), DE 19615985 C1 (PCT/DE97/00715), DE 19636167 C1 (PCT/DE97/01939), PCT/DE 96/02120, PCT/DE96/01276 and DE 19749780

Two letters of Dez. 5, 96 and Oct. 11,97 incl. patent doc/appls were registered forwarded to Mr Ricardo Martinez MD who neither replied to the measures enhancing survival chance nor acknowledged of receiving.

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Washington DC 20590

Dr. -Ing. Giok Djien Go

Registered

Mr President of NHSTA
National Highway Traffic Safety Administration
400 Seventh St. S.W
Washington DC 20590
USA

Ejection of passengers from the passenger compartment
Court verdict against Chrysler

Dear Mr President,

Enclosed you find my two letters to Mr Martinez MD disclosing the above-mentioned subject and other thesis. Unfortunately, he has not spent his utmost valuable time to reply and study my documents as well as inventions according to PTC verdict "absolute new". In comparison, the EU commision has taken contact with me and mailed the latest survey-papers.
Institute für Fahrzeugsicherheit (Büro für Kfz-Technik) and Deutscher Verkehrsicherheitsrat have issued out a number of recommendation-letters.

I may refer to the decision of NHSTA in association with Customers Union for promoting "smart" front airbag and switching on/off the front airbag which won't solve the problem of false deployment. These problems can be resolved only by my inventions in modern way without on/off switch. No "smart" and expensive front airbags are necessary. Some documents were mailed to Customers Union. Please contact them.

If the reduction of fatal and severe injuries is the main concern of your agency, I am inclined to discuss my *whole work* (see enclosed agenda) plus my 11th patent application with you, members of your agency and the authorized officers of American Car Industry in your HQ whereto I am willing to licence. Would your agency reimburse my travelling expenses?
After having listened my 2.5 hours presentation those 12 experts of a very big carmaker are surveying my whole work whereafter I will do presentation again.

Please let me know your fax-number and internet-ID. Between Nov 14 and 26 you can contact me in Toronto by dialing 001416 495 9216.

Thank you for your attention and interest in advance.

kind regards

Dr. Go

Attached
presentation agenda, letters to Mr Martinez MD and letter of Customers Union.

Besonderes Augenmerk richten wir auch auf die Verbesserung von Rückhalteeinrichtungen und dabei insbesondere auf Gurtsysteme, die allerdings hinsichtlich der Bedienfreundlichkeit ihren heutigen Standard unbedingt behalten müssen, da sonst die Gefahr besteht, daß die Systeme nicht genutzt oder so benutzt werden, daß die Rückhaltewirkung gegenüber bekannten Systemen nicht erreicht wird.

Auf absehbare Zeit ist nicht daran gedacht, unsere grob umrissene Philosophie grundlegend zu ändern. Deswegen sehen wir derzeit leider keine Möglichkeit, einen Ihrer Vorschläge bei unserer Entwicklungstätigkeit zu berücksichtigen. Sie gestatten uns jedoch sicherlich, daß wir auf Ihr freundliches Angebot zurückkommen, sobald sich aus unserer Sicht ein entsprechender Bedarf abzeichnet.

Mit freundlichen Grüßen
Daimler-Benz Aktiengesellschaft

Einsele

i.V. Auer
Auer

Anlage
Ihre Unterlagen

C → German Patent
B → European

ENERGY-ABSORBING FLOOR-ASSEMBLY OF MOTOR VEHICLE

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part application of co-pending international application number PCT/DE 97/00715 (WO 97/39937), filed Sept. 4, 1997 and claiming the priority of German Patent Doc. DE 19615985 C1, filed April 22, 1996. The symbol "C" of DE 19615985 "C"1 indicates a German Patent and "B" an European Patent such as European Patent Doc EP 0844939 "B"1. Contrarily, the symbol "A" indicates a German and European Pending Patent such as DE 4224489 "A"1 and EP 0565501 "A"1.
German and European Pat. Appls. or Docs., which will be omitted, are designated by the abbreviations "DE" and "EP" hereinafter.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to an energy-absorbing vehicle floor of motor vehicle, more particularly, to the large area (region) between the front pillars (post sections or pillar portions) and the rear bumper, which is exploited to accommodate at least one deformable element. This deformable element is equipped with at least one pair of independently operating piston devices, in which a pair of springs is installed,

- to store minor energy when the bumper is loaded and to return the bumper back, when unloaded, to the home position, and
- to absorb (dissipate) large (major) impact energy in the event of arbitrary collision (front-, side- or rear collision) or pile up (mass accident).

Other objects disclose a deformable floor of a trunk compartment in the front or rear section of vehicle body, wherefrom the floor is releasable and detachable. Rooms formed by this upper floor and a lower deformable floor can be used for storage.

2. Description of the Related Art:

It is known in the prior art to construct a vehicle frame for motor vehicle defining the shape of the vehicle, for sustaining various loads and for co-operating with deformable longitudinal runners and/or deformable elements to absorb the impact energy in a real accident. However, the proven deficiencies of this construction [11, 12] are due to the inapplicability or limited applicability of the prior art, which undergoes the examination in the following description and will be improved by the present invention.
For years R&D (Research and Development) work has been focused on developing compact cars suitable for every day driving that help resolve the problems of increasing traffic density, make it easier to park and lower the fuel consumption to under 4 litre for 100 km. These prototypes at the Automotive Salons or Shows were AUDI A2 ®, Opel Maxx ®, MB A-Class ®, MCC Smart ®, Honda Logo ®, VW Lupo ®, Toyota Yaris ®, etc. In autumn of 1997 Mercedes Benz was the first car manufacturer to offer a full-sized four-seater compact car of MB A with a baby carriage-sized trunk compartment (storage compartment), illustrated in **Figs.** 2a, 3a.

Serving as deformable elements ref. to DE 4224489 A1, DE 3925990 A1 and DE 3826958 A1 and DE 4342759 C1 both front portions of longitudinal runners in association with the front section of vehicle structure convert the impact energy into deformation work to reduce the acceleration in the event of mid-front collision.

Ref. to DE 3826958 A1 the rear section of front portion of each longitudinal runner, in abutting relationship to the passenger compartment (cell), has the greatest stiffness while the deformable front section, whereto an auxiliary deformable element having variable cross section in longitudinal direction is fastened, has variable stiffness in longitudinal direction for the purpose of controlling the rate of acceleration and determining the start of pre-tensioning the belts in mid-front collision.

A safety device ref. to DE-OS 2121464 discloses a brake system which should able to decelerate at 60 m/s^2 in order to pre-tension the seat belts within 8 ms, noted in to DE 3826958 A1. Based on the brake-deceleration of 9.9 m/s^2 for VW Passat ® [7], 8.4 m/s^2 for VW Polo ® [8] at the speed of 100 km/h, the linear equation $t = v/b$ yields a brake-time of 2.8 s and 3.3 s. In 60 ms the curve converges towards zero. Accordingly, the safety device with a 50-times power of brake-deceleration would be complex to construct, hence, expensive.
Another safety device includes a common cross member laterally attached to the middle of the vehicle floor and connected to four rods of the front bumper, provided with four coil springs, and to three rods of the front bumper, provided with three coil springs. This safety device, suited for storing energy, is incapable of absorbing impact energy.

Ref. to DE 4224489 A1 extrusion components used for the front portions of longitudinal runners are fabricated from light materials such as aluminium, magnesium or alloys thereof. In dependence on the following cross sections 4-, 6-, 8-edges, 4-edges with strut, round profile with strut the mass-dependent energy absorption and the buckling force were surveyed. The result thereof has encouraged the assignee AUDI Corp. to assemble a pair of extrusion components in AUDI A8 ®. Unfortunately, due to lack of sites of predetermined fracture those components under load are subjected to lateral buckling. Responsive to that deficiency the front and/or rear portions of longitudinal runners, made of light materials, ref. to US 5,480,189 are provided with sites of predetermined fracture. However, the energy-absorbing device does not work in the event of offset, inclined front or rear collision, illustrated in **Figs.** 39 to 43.

As exemplified in DE 3925990 A1, each pair of energy-absorbing front and rear portions of longitudinal runners is supported by a pair of energy-absorbing devices in order to prevent lateral buckling thereof in the event of mid-front or mid-rear collision. From all exemplary teachings of the prior art this is the most promising invention thanks to the following features:

1. During the deformation in a mid-front collision both energy-absorbing subframes (spring domes) move downward and underneath the passenger compartment which is subjected to less acceleration thus lowering injury severities.
2. The device including three pairs of energy-absorbing deformable elements achieves the largest amount of energy absorption.

Unfortunately, these voluminous pairs, suited for MB S, cannot be accommodated in a compact, small- and mid-size car. Responsive to that deficiency a large force resulting form a mid-front collision is absorbed by a pair of energy-absorbing front portions of longitudinal runners that co-operate with a pair of C-shaped energy-absorbing members of subframes of MB C, ref. to DE 4342759 C1, in abutting relationship to the passenger compartment subjected, unavoidably, to the remaining load. Moreover, the collapse of the passenger compartment of MB C200 [11] in a real accident, illustrated in **Fig.** 43, documents the failure of the prior art.

Due to the uniform displacement of the power train (drive train) ref. to DE 3301708 C2 and DE 4405904 C1 in the event of mid-front collision only minor energy can be absorbed by a deformable element arranged therebehind and attached to the tunnel.

Ref. to DE 4406129 A1 a front mechanism **200** comprises the front bumper **35**, two connecting rods **208**, a cross member **210** and an energy-absorbing panel **216** installed in the rear section of vehicle structure. A rear mechanism **201** comprises the rear bumper **36**, two connecting rods **209**, a cross member **211** and an energy-absorbing panel **215** installed in the crumpling section of the vehicle structure. Each panel **215, 216** is interposed between the respective bumper and cross member arranged outside of the passenger compartment **203** defined by the dotted lines shown in **Fig.** 34. In the event of mid-front or mid-rear collision the connecting rods **208** or **209** can move, only in parallel relationship to each other, in the channels **212** (**Fig.** 35) to push the cross member **210** or **211** deforming the energy-absorbing panel **216** or **215**.
Unavoidably, the rotation (yaw-angle) of the vehicle about the high axis of the centre of gravity of the vehicle in arbitrary front collision will be increased due to the position of the cross member behind the centre of gravity of the vehicle and to the rigid connection of both rods to each other (**Figs.** 40, 42, 43)

As exemplified in **Figs.** 36 to 38 of DE-OS 2225481, a safety device **220** comprises two girders **231, 232** pivotally connected to each other by a joint **223**, a suspension system [1 to 3] consisting of a coil spring **225** and shock absorber **226** in force-locking connection with two girders **241, 242**. This safety device, pivotally connected to two bearings **221, 222** of front and rear axle, is subjected to the following load cases in compliance with Technical Mechanics:
*Load case I in the z-y plane (**Fig.** 36):* The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of the length l. From the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. These three forces in z-direction $-V$, $(H_A + V_A)$ and $-(H_A + V_B)$ exert the bending moment M_{zy} along the y-axis imposed on the safety device.
*Load case II in the z-x plane (**Fig.** 37)*: The force V exerts the bending moment $M_{zx} = V*b$ imposed on the safety device along the y-axis.
*Load case III in the x-y plane (**Fig.** 38)*: The safety device is subjected to the bending moment $M_{xy} = -H*b$ along the x-axis and buckling force H.
The bending moments M_{zx}, M_{xy}, M_{zy} and buckling force H yield the total stress which is in contradiction to the compressive or tension stress, noted in DE-OS 2225481.

In co-operation with a pair of dependently operating piston devices assembled in the front portions **30.1** of both runners ref. to US 3,860,258, FR 2181044 A and GB 2169377 A, the respective features of energy absorption

- contradict the concept of compact car limited by an extremely short front section of the vehicle body e.g. approx. 50 cm of MB A
- fail to absorb energy in the event of offset or inclined front collision (**Figs.** 39, 41, 43) because both piston devices can only operate in dependent relationship to each other and
- increase the rotation of the vehicle about the vertical axis thus yaw-accelerating the heads of restrained passengers. In the event of 40 % offset Euro-NCAP (European New Car Assessment Programme) test [9] the vehicle VW Golf IV, driven at 64 km against a deformable barrier, rotates about 80^0, substantially more than the yaw angle of the similar vehicle in a 50 % offset crash against a stiff barrier (**Figs.** 40, 42).

Ref. to US 3,860,258 the similar corrugated portions (zones) of the longitudinal runners and side rails should control the rate of acceleration in mid-front collision. Due to the constant stiffness thereof a single rate of acceleration will be achieved abruptly and immediately. Obviously, the corrugated zones weaken the overall stiffness of the vehicle frame which will collapse in side collision.
Furthermore, the operation of telescoping bumper is restricted because the pair of telescopic energy absorbers can work only in mid-front collision.

By applying the Newton law "action = reaction" the pair of hydraulic piston devices ref. to GB 2169377 A proposed for energy absorption would be as bulky and expensive as the $ 10 millions hydraulic device of Carl Schenck or Mannesmann Corp. which builds up the energy to accelerate a vehicle in a crash test.

Ref. to FR 1181569 and DE-OS 2211976 a pair of shock absorbers is rigidly connected to the front bumper and a cross bar of the vehicle frame to store minor energy resulting from the mid-front collision of the car, when parking, against a hindrance and upon the release of the stored energy to return the bumper to the home position when the car is reversed.

In comparison with a small car VW Polo ® with length x height x width = 3.71 x 1.42 x 1.66 m compact cars have a shorter length such as MB A with 3.58 x 1.56 x 1.72 m and Opel Maxx ® with 2.97 x 1.58 x 1.58 m. In spite of airbags, belt pre-tensioners and reinforcing elements, the larger, stiffer vehicle structure of conventional cars and vans cannot always ensure survival chance in real accidents [11, 12]. Conceivably, the very small size of compact cars reflects the strenuous R&D work to resolve the problems of energy absorption in the event of front-, rear- or side collision. Furthermore, the following goals are at cross-purposes. Those specifications of crash tests are usually met by a complex, costly design to enhance the survival chance at extremely low manufacturing costs.

The current development of compact cars and small-size vehicles is attributed to the following teachings of the latest prior art regarding passenger protection and manufacturing method:

Extrusion components fabricated from light materials are used for the supporting members of the vehicle door, frame, cross members, side rails and pillars ref. to DE 4335043 A1. A vehicle floor and door are assembled by plug-in connecting the engaging pieces of each member into the mating profiles, sockets and/or holes of the other and by glueing them. The high manufacturing costs are partly compensated by the relatively inexpensive, simple methods of assembly and preserving the tolerance zones, however, not sufficiently enough to justify serial production. Presumably, the problems of energy absorption remain unsolved.

Ref. to US 5,911,426 and 5,921,578 a small shock-dispersing plate **606** and a pair of deformable portions of leading arms **603** of a battery-driven compact car Honda, shown in **Fig.** 44, have energy absorption, far less than that front portions of the pair conventional runners of the compact car MB A ref. to US 5,492,193 that co-operate with the undermentioned deformable element **56** ref. to DE 4326269 C1, shown in **Figs.** 2a, 3a .
In mid-front collision both deformable portions of leading arms are outwardly deformed thereby outwardly displacing both wheels out of interference with the respective side rails.

However, in an arbitrary front collision, shown in **Fig.** 43, only one of the deformable portions of leading arms will be deformed to a limited extent due to the interference of the corresponding wheel with the cross member thereby transmitting the remaining energy to the vehicle frame and increasing the rotation of the vehicle.
In a worst case the left front tire hits the curbstone **611** of a pavement when parking the contact force deforms the deformable portion of left leading arm **603**, shown in **Fig.** 45. How many rims, wheels and suspension systems of the vehicles have been damaged when parking?

The shortcomings of the above-mentioned prior art become apparent in the following front collisions:

- In a 50 % offset crash test, shown in **Figs.** 39, 40 [6], two similar cars MB 230s, rotate at yaw angle "A" = 40^0 about the vertical axis of the mutual point of collision away from the mutual collision line thus exposing the occupants to neck injuries associated with large yaw-acceleration. The need for independently operating piston devices of the present invention is substantiated by the failure to absorb the remaining energy, which forcefully opens the trunk cover **601** of each car.
- In an approx. 50 % offset crash test, shown in **Figs.** 41, 42 [10], a 1480 kg heavy VW Passat **700a**, moving forward to 1 metre, rotates at yaw angle "D" = 35^0, while a 1107 kg heavy VW Polo **600a**, thrown backward to 5 metre, rotates at yaw angle "A" = 45^0 thus backward, rotatably (yaw-) accelerating the heads of restrained dummies of VW Polo.
- The passenger compartment of a two-years old MB C200 **700b** is collapsed to approx. 40 % of its original size by a eight-years old VW Passat **600b** crushing into it at an angle "A_c" = 35^0, shown in **Fig.** 43 [11], resulting in a fatality of the MB C200 driver and severely injured passengers of VW Passat. This accident, outside of the city Idstein, demonstrates the failure of passenger protection of one of the safest cars. It should be clearly understood that Porsche-, MB- and Volvo cars are reputed to be the safest cars in the world and ensure a far better survival chance than other cars in real accidents, as documented in [12].

With the exception of DE 4326269 C1, the deformable elements of the prior art don't fit in a compact car, small- and mid-size car. Ref. to DE 4326269 C1 a deformable element **56** of MB A (**Figs.** 2a, 3a) consisting of honeycomb-shaped energy-absorbing members is in form-locking connection to the front portions **50.1** of longitudinal runners and detachable therefrom. Due to the small size (area) the deformable element is incapable of absorbing large impact energy.

The feature of four stiff impact elements **55a to 55d** (**Figs.** 2a, 3a) ref. to US 5,464,266 (DE 4326270 A1) for energy absorption in side collision is not appropriate. These stiff elements, incapable of absorbing energy, transmit energy from one vehicle side to the other and to the passengers. In the worst case, the residual lateral force rolls the MB A over due to the high centre of gravity of the vehicle. Such stiff elements were already proposed by Volvo Corp. in EP 0565501 A1 disclosing five stiff cross members to transmit energy into the floor. In a side crash test according to FMVSS 214 a 12 litre side airbag cushioning the head lowers the acceleration of chest by 14% while increasing the acceleration of pelvis by 4% despite the five stiff cross members and the side airbag. Passengers are exposed to higher injury severities because the test data are two-times higher than that in a front crash test, described in EP 0844939 B1 (DE 19530219 A1, US 09/210,420) disclosing the side-airbag substitutes superior to expensive, unreliable side airbags. Of all real collision types

the highest rate of severe and fatal injuries is discovered in real side collisions due to the lack of crumpling (crush) section and the medical thesis, that the neck muscle and vertebrae in the lateral direction are weaker than in the longitudinal direction [12].

None of the above-mentioned configurations offer the simplicity of the present invention in

- arranging the large deformable element, whose area is more than **four times** as big as the area of the element **56**, between the front pillars and the rear bumper **36** to absorb much larger impact energy;
- arranging a pair of independently operating piston devices in the in the front and/or rear section of the vehicle body to independently deform the large deformable element and
- substantially improving the survival chance of a vehicle, taken as example the compact car MB A (**Figs.** 2a, 3a), by modifications. Responsive to the deficiencies of US 5,464,266 and EP 0565501 A1 the compact car "GO", shown in **Figs.** 2 to 5, is provided with the interengaging assemblies ref. to. EP 0869878 B1 (US 08/860,182) to connect the doors, pillars, side rails and vehicle roof to each other in arbitrary collision, with the impact beams **20, 20a, 20b** and spring elements **21** ref. to DE 4342038 A1 and at least one deformable element **1, 3** (**Figs.** 1, 31 to 33), preferably, a pair of side deformable elements **2, 2a** to **2e** (**Figs.** 1 to 6, 15 to 18, 32) in order to define a crumpling section for each vehicle side. The front-end or rear-end of the deformable element **1** and/or deformable element **3** is/are capable of absorbing large impact energy in any front or rear collision.

SUMMARY OF THE INVENTION

Accordingly, the principle object of the present invention is to optimize the crush behaviour of the vehicle floor, more particularly, of an energy-absorbing floor-assembly in order to substantially reduce large accelerations in the event of arbitrary collision.
This principle and other objects of the present invention are accomplished by the following features (proposals):

- a well-defined controllable deformation behaviour of the deformable element to determine the absorption of subenergies, the total amount of which represents the impact energy, in order to yield the highest efficiency of energy absorption during the controllable folding and buckling;
- a large-area deformable element arranged to the vehicle floor and interposed between the front and rear bumper;
- independently operating piston devices in the front and/or rear section of the vehicle body to guide and to independently deform the respective deformable elements, particularly, in the event of arbitrary front or rear collision;
- a pair of springs co-operating with the independently operating piston devices to store minor energy, when the bumper is loaded, and to return the bumper to the home position when the bumper is unloaded;
- space-saving design for the guided piston rod;
- form- and/or force-locking connection of the deformable element with frame members, wheel cases and/or auxiliary parts in order to avoid the lateral buckling;
- form- and/or force-locking connection of the deformable elements with each other by means of interengaging assemblies in order to increase the energy-absorbing masses in any collision and

- detachable and releasable deformable element, serving as an upper floor of the trunk compartment, to cover the storage room for a spare tire, briefcase etc.

thus resolving the shortcomings and deficiencies of the prior art, substantially lowering the deceleration rate and exploiting the advantages of the energy-absorbing features in a useful construction.

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*vehicle floor between the A- or front pillars and the rear bumper*"	a part of the vehicle floor regionally restricted by both A- or front pillars, the rear bumper and both side rails.
"*frame member*" **30 to 34** of a vehicle frame	any longitudinal runner, cross member, tunnel rail or side rail (sill portion)
"*deformable element*" **1, 2, 3** for energy absorption	any energy-absorbing element to convert the impact energy into work of deformation
"*deformable members*"	members of a deformable element
"*auxiliary part*" of a deformable element	auxiliary tube, plate or element for the purposes of guiding and/or fastening a deformable element to the vehicle floor
"*arbitrary collision*"	front, side or rear collision in arbitrary direction of impact force e.g. **Y** at the arbitrary angle "β" or at angle "A_c" (**Figs.** 2, 43)
"*arbitrary front collision*"	front collision in arbitrary offset or arbitrary offset front collision
"*acceleration*"	impact acceleration or deceleration of vehicle during an arbitrary collision
"*stiffness*" of a deformation- or an auxiliary element	stiffness matrix of an element in the direction of impact force **X, Y** or **X1** (**Fig.** 31); See FEM-books
"*site of predetermined fracture*"	recess, hole, oblong hole, cut-off, corrugation or crack
"*predetermined site*"	welding spot, engaging point or assembling point
"*engaging part*" of an interengaging assembly	engaging screw, bolt, pin, rivet, block or element
"*mating receptacle*" of an interengaging assembly	mating hole, recess, oblong hole or cut-off
"*energy absorption*"	energy is absorbed by a deformable element upon the release of stored energy when the sites of predetermined fracture are broken

Summary of the advantages of the present invention:

I. The independently operating piston devices comprising parts **5, 5.1, 1.2** and coil springs **4c, 4d** independently deform the respective sections of deformable element **1** (**Figs.** 1, 10, 31 to 33) in the event of arbitrary front or rear collision and independently telescope to store minor energy when the bumper is loaded and to return the bumper to the home position when the bumper is unloaded.

II. Decrease of the amplitude, increase of the eigen-frequency of torsional oscillation, increase of the stiffness of the vehicle frame, reduction of vehicle-weight and substantial deceleration in the event of arbitrary collision by

- arbitrarily attaching a single large-area deformable element **1** (**Figs.** 31, 33) or a number of deformable elements **1, 2, 3, 3a to 3c** (**Figs.** 1 to 4, 15 to 22, 32) to the very large area of vehicle floor between the front or A-pillars and the rear bumper thus solving the deficiencies of the above-listed prior art;
- increasing the energy-absorbing masses by means of interengaging assemblies to connect the deformable elements to each other (**Figs.** 15 to 18, 32), one of which is proposed for energy absorption in front or rear collision and the other for side collision. This overall proposal for energy absorption in any accident is superior to the two individual energy-absorbing systems ref. to US 5,464,266, US 5,492,193 and DE 4326269 C1, above-mentioned, suited for energy absorption in mid-front collision or for energy transmission in side collision;
- increasing the energy-absorbing masses via maximizing the height "h2" of the side deformable element **2a** (**Fig.** 6) and deformable element **2a1, 2a2** incorporated with deformable element **2z** (**Fig.** 23). The height "h2" (**Fig.** 6) is determined by the difference between the vehicle floor **57** and road level "h_B" (**Fig.** 3) serving as clearance for the vehicle floor to the road surface or between both vehicle floors **57** and **57a** of the compact car "AC"; and
- force-locking connection of the auxiliary tubes **60b, 60c, 60c1, 60c2** and/or deformable elements with the frame members.

III. In form-locking connection with frame members and wheel cases, illustrated Figs. 1 to 2, 19 to 22, the deformable element **3, 3a** absorbs energy in arbitrary rear or side collision and acts as a releasable floor of the trunk compartment used to cover the storage rooms and to protect the items therein from theft. This feature is applicable too for a trunk compartment in the front section of the vehicle body.

IV. Minor or no impact force imposed on the passenger compartment thanks to control rate of deceleration upon the release of subenergies, the total amount of which represents the impact energy, in excess of the threshold value of the sites of predetermined fracture of deformable elements during the controllable folding and buckling.

V. When a vehicle tunnel is needed for housing an exhaust pipe, drive shaft (drive line) etc., the tunnel rail **60, 60d** (**Figs.** 1 to 2, 31, 33) is replaced by auxiliary tubes **60b, 60c, 60c1, 60c2** (**Figs.** 23, 29 to 32), auxiliary plates **31.5, 32.5, 32.6, 33.5** (**Figs.** 24, 32) and/or a pair of tunnel rails **60e** (**Fig.** 32), between which an accommodation space is defined.

VI. Use of the ledge of the side deformable element **2a1 to 2a3** (**Figs.** 6, 23, 32) for

- step rail **2.8** facilitating (disabled) occupants to comfortably step in and out due to the high side rail of compact car, van and small bus and/or
- side bumper of element **2a3** (**Fig.** 32) with or without the deformable impact beam **20b** (**Fig.** 5) to directly absorb impact energy.

Like the front section of the vehicle structure each lateral crumpling section comprises a side bumper and a pair of deformable elements.

VII. Honeycomb-shaped deformable elements serve as a means to dampen road noise. See honeycomb-shaped floor parts ref. to DE 3809185 C2 made of *paper* to dampen road noise.

VIII. Passing the strict EU- and US- side crash tests with a few modifications of the vehicle floor of a prototype or production model. The modifications of MB A "AC" into a compact car "GO" substantiate the applicability of the deformable elements for any vehicle floor.

IX. Costs cut by standardizing the deformable elements with arbitrary cross section and contour for vehicles of different classes, by minimizing the number of the types and/or by employing a single deformable element **1** (**Fig.** 33).

X. Inexpensive design, low manufacturing costs, high reliability, low reject rate and saving labour-time thanks to simple assembly, disassembly and repair.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments, other advantages and features of the present invention of motor vehicle will be described in the accompanying drawings with reference to the xyz global coordinate system:

Fig. 1 is a schematic perspective view of the 1st embodiment of a vehicle floor of a compact car "GO", an energy-absorbing improvement over the vehicle floor of a prototype MB A ® of **Fig.** 2a and 3a, equipped with five elements deformable under the imposition of impact force **X, Y** or **X1** in the event of front, side or rear collision or pile up.

Fig. 2 is a bottom plan view of the 1st embodiment of the vehicle floor in yz plane.

Fig. 2a is a bottom plan view of the vehicle floor of the MB A ® "AC", ref. to US 5,464,266 (DE 4326270 A1) and DE 4326269 C1, in yz plane comprising two runners, side rails, bumpers, an A-, B-, C-cross member, a front deformable element and four impact elements under the imposition of impact force **X** or **Y** in the event of front or side collision.

Fig. 3 is a cross-sectional view of the 1st embodiment of the vehicle floor along the line II-II of **Fig.** 2.

Fig. 3a is a cross-sectional view of the MB A "AC" along the line II-II of **Fig.** 2a.

Fig. 4 is a partially enlarged cross-sectional view of **Fig.** 3.

Fig. 5 is a cross-sectional view of a vehicle door and a side deformable element with a ledge serving as a step rail along the line II-II of **Fig.** 2.

Fig. 6 is a perspective view of the side deformable element having a ledge.

Fig. 7 is a cross-sectional view of a shearable bolt of the side deformable element in engagement with the mating hole of a piece along the line I-I of **Fig.** 4.

Fig. 8 is a cross-sectional view of a shearable pin engaging with the side deformable element.

Fig. 9 is a cross-sectional view of the side-end portion of the deformable element bolted to the C-cross member along the line III-III of **Fig.** 2.

Fig. 10 is a schematic perspective view of the 1st embodiment of a deformable element subdivided into crumpling zones provided with sites of predetermined fracture, engaging points and/or honeycomb-shaped energy-absorbing members.

Fig. 11 is a perspective view of the 2nd embodiment of a deformable element of varying stiffness and an additional deformable element of longitudinally varying stiffness.

Figs. 12 to 14 are perspective views of the respective 3rd to 5th embodiment of a deformable element having an outer or inner guide tube to receive a round auxiliary tube.

Fig. 15 is a perspective view of the 6th embodiment of a deformable element in a form-locking connection with a mating deformable element via the 1st embodiment of interengaging assemblies distributed along the upper and lower region thereof at one assembling side.

Fig. 16 is a perspective view of the 7th embodiment of the deformable elements of Fig. 15 provided with the 2nd embodiment of interengaging assemblies.

Fig. 17 is a perspective view of the 8th embodiment of the deformable elements of Fig. 15 provided with the 3rd embodiment of interengaging assemblies.

Fig. 18 is a perspective view of the 9th embodiment of the deformable element and a mating deformable element, both provided with the 4th embodiment of interengaging assemblies.

Fig. 19 is a cross-sectional view of the 1st embodiment of a deformable element of the trunk compartment, in form-locking connection with the rear portions and wheel cases, and storage rooms along the line V-V of Fig. 2.

Fig. 20 is a partially enlarged cross-sectional view of Fig. 19 to illustrate the honeycomb-shaped energy-absorbing members, engaging pin and hinge.

Fig. 21 is a top view of the 2nd embodiment of a half of a deformable element of the trunk compartment in form-locking connection with the rear portion, engaging rail and wheel case.

Fig. 22 is a perspective view of the process to form-locking connect the members of the deformable element of Fig. 21 to each other and to the respective frame members.

Fig. 23 is a schematic perspective view of the 2nd embodiment of a vehicle floor comprising open cross sectional frame members to receive deformable elements and bearing boxes.

Fig. 24 is a schematic perspective view of the 3rd embodiment of a vehicle floor comprising open cross sectional frame members to receive deformable elements and bearing boxes.

Fig. 25 is a perspective view of a bearing box and its parts.

Figs. 26 to 28 are front views of the 1st to 3rd embodiment of an open cross sectional runner in form- and force-locking connection with a bearing box.

Figs. 29 to 30 are bottom plan views of the 4th to 5th embodiment of a vehicle floor having at least one leaf spring serving as a deformable element.

Fig. 31 is a bottom plan view of the 6th embodiment of a vehicle floor provided with the respective deformable elements for energy absorption in arbitrary collision.

Fig. 32 is a bottom plan view of the 3rd embodiment of the vehicle floor of Fig. 24 provided with the respective deformable elements for energy absorption in arbitrary collision.

Fig. 33 is a bottom plan view of the 7th embodiment of a vehicle floor provided with the respective deformable elements for energy absorption in arbitrary collision.

Fig. 34 is a perspective view of two mechanisms ref. to DE 4406129 A1 under load of front- or rear impact force.

Fig. 35 is a cross-sectional view of a half of the vehicle and two connecting rods in a channel along the line VI-VI of **Fig.** 34.

Figs. 36 to 38 are schematic views of a safety device ref. to DE-OS 2225481 under load of impact forces in zy-, zx- and xy-plane.

Figs. 39 and 40 are top plan views of two similar cars rotated at the same angle about the vertical axis of the mutual point of collision in a 50 % offset crash test.

Figs. 41 and 42 are top plan views of two cars with different weights in an approx. 50 % offset crash test.

Fig. 43 is a top plan view of two cars in a real accident.

Fig. 44 is a top plan view of a safety device ref. to US 5,911,426 and 5,921,578.

Fig. 45 is a top plan view of the safety device of **Fig.** 44 when the tires of the car hit the curbstone of a pavement.

As customary, the use of (not shown) sealing parts against dirt and water is highly recommended for the purpose of securing the function of the piston device, however, not shown for the sake of perspicuity.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Beyond doubt, the function of the deformable elements is well described in the preferred embodiments of the prior art. However, the applicability thereof would become apparent in the scope if the explanation of how to assemble the deformable elements to the vehicle frame in reference to the **Figs.** would be included. When the assembly process is known, the costs and time can be estimated. Hence, this subject must be taken into account when the function and assembly thereof is described in conjunction with manufacturing parts thereof and absorbing large energy in the event of arbitrary collision.

The right-hand drive vehicle is represented by the steering wheel **81** drawn with dotted heavy lines (**Fig.** 3), the position of each pillar and cross member in all **Figs.** by the capital letters A, B and C (**Figs.** 2, 31). It is to be clearly understood that the features are applicable for any vehicle with an arbitrary number of pillars and cross members, accordingly for any vehicle floor. The driving direction shown in all **Figs.** is opposite to the x-direction of the xyz global coordinate system illustrated **Figs.** 1 to 3, 10, 15, 19, 31.

With the exception of the detachable deformable elements **3** and **3a** serving as a releasable floor of the trunk compartment the deformable elements are housed in the vehicle floor or under the vehicle floor **57** (**Figs.** 3a). By applying the associative rule the parts of each interengaging assembly can be arranged to the mutual deformable elements in either way **1** *and* **2** or **2** *and* **1** (**Figs.** 15 to 18, 32 to 33).

In analogy to the principle of "*piston engine*" to perform work, the piston **1.2** guided by the bearing box "compresses" or deforms the *deformable element* (**Figs.** 1, 2, 10, 31 to 33) under load of impact force in the event of collision against the barrier **80** (**Fig.** 3a) or the opposite vehicle (**Figs.** 39, 41, 43). Due to the constant stiffness of the crumpling zones of longitudinal runner e.g. ref. to US 5,480,189, US 3,860,258 the total energy absorption occurs *abruptly and immediately* despite the proposal for controllable folding and buckling thus making a control of the rate of deceleration impossible. In order to ensure a time-dependent curve of acceleration (deceleration) lower than the threshold value of severe/fatal injury during the collision, large-area (proper term: large-volume) deformable elements with controllable deformation behaviour are required. Any deformable element having an *arbitrary* cross section and contour is subdivided into a number of crumpling zones $\mathbf{Z_1}$, $\mathbf{Z_2}$,

Z_3, Z_4,.. Z_{n+1} with sites of predetermined fracture (**Figs.** 10, 12, 16, 18, 21). Controllable deformation behaviour is determined by inequal stiffness of crumpling zones in juxtaposition having *different peak stresses* under load. However, they may have peak stresses at the same level as long as their crumpling zones e.g. Z_2 and Z_{10} are not in juxtaposition. The transient times to the yield value (fracture stress) are variable, hence, determinable by the **design features** of stiffness-varying crumpling zones in the 1st to 9th embodiment of a deformable element:

1) *number and/or inequal distances of sites* ref. to **G1** (design-features-type **1**) such as welding spots (**Fig.** 10), transition sites (engaging points) P_1, P_2, P_3, ... , P_n (**Figs.** 16 to 18) or assembling points R_1, R_2, R_3, ... , R_n (**Figs.** 24, 32);
2) *sites of predetermined fracture* such as recesses, oblong holes ref. to **G2**, holes ref. to **G2a**, cut-off in welded area ref. to **G2b**, rounded cut-off in welded area ref. to **G2c**, cracks ref. to **G3** or corrugations ref. to **G4**. The juxtaposed crumpling zones of a deformable element can be separated by a transition area defined by recesses ref. to **G9** (**Figs.** 12, 13). To prevent from buckling laterally the deformable element is provided with at least one guide tube **1.8a**, formed by two half-rings (**Fig.** 14), or with at least one guide tube **1.8** (**Figs.** 12, 13), wherein an auxiliary tube **60b, 60c, 60c1, 60c2** (**Figs.** 31 to 33) is inserted to guide the deformable element during energy absorption and to prevent lateral buckling thereof.
3) *honeycomb-shaped energy-absorbing members* ref. to **G5** like deformable element **2** illustrated partially (**Fig.** 1), deformable element **1** (**Fig.** 10) and deformable members **3.1, 3.2** (**Fig.** 20);
4) *integrating additional part thereon or therein* ref. to **G6**;
5) *longitudinally varied stiffness of a deformable element* **1a** with angle α (**Fig.** 11) ref. to **G7**;
6) *integrating an additional deformable element* **1z** *of varying stiffness therein* ref. to **G8** (**Fig.** 11);
7) *multi-leaf spring as deformable element* ref. to **G10**, e.g. three leaves, mounted laterally (**Fig.** 29) or longitudinally (**Fig.** 30). In dependence on cracks, holes ("b" is a hole of the spring element **21** (**Fig.** 5)), different radii of curvature of leaves and/or different thickness the sites of predetermined fracture can be pre-calculated by FEM, hence, varied [1 to 3]. Moreover, other materials with the properties of high-energy absorption and small mass, e.g. used for skis, like carbon/glass fibre-reinforced plastics are recommended for use.
8) *interconnection of the first deformable element 1e, 1f, responsible for energy absorption in front- or rear collision, and the second deformable element 2b to 2e, responsible for energy absorption in side collision, by interengaging assemblies* ref. to **G11** (**Figs.** 15 to 18) increases the energy-absorbing masses in any collision. The stiffness of the transition area of juxtaposed crumpling zones is weakened by L- or T- (spade-) shaped oblong holes or recesses. Parts of deformable element are fabricated and formed by shallow drawing, extruding, welding, bolting, riveting and/or glueing. The deformable element **1** with struts (**Fig.** 10) is formed either by welding four sheet metals (panels) **1.10, 1.11** together or from light weight material by extrusion. Finally, the recesses of the deformable element **1f** are machined to serve as sites of predetermined fracture and to receive the engaging pins **2.1b** (**Fig.** 18).

It is obvious that the lateral buckling of the deformable element can be prevented and the deformation behaviour thereof can be controlled by different peak stresses of juxtaposed crumpling zones and the mutual direction of the deformation of all the crumpling zones and the movement of the piston **1.2** (**Fig.** 10). To cut costs a single deformable element **1** (**Fig.** 31) is designed in association with the above-mentioned design features to define the sections each of which is responsible for energy absorption in the event of front, side or rear collision.

The 1st to 4th embodiment of the interengaging assemblies determines the crumpling zones of the first and second deformable element **1e, 1f, 2b to 2e**. The insertion of the mating parts of interengaging assemblies makes the assembly of the second deformable element to the first deformable element easier thus saving costs and time. Ref. to **Fig.** 15 the interengaging assemblies consist of upper and lower engaging pins **1.15** distributed on the respective upper and lower transition areas of juxtaposed crumpling zones of the first deformable element **1e** in x-direction and the mating L-shaped oblong holes, distributed along both legs of the U-shaped portion of the second deformable element **2b**, serving as upper and lower transition sites of juxtaposed crumpling zones thereof. Both deformable elements are interconnected upon the insertion of the mating L-shaped oblong holes into the upper and lower engaging pins in y-direction, which are secured in the U-forms of the mating L-shaped oblong holes by the movement of the second deformable element in x-direction. If necessary, a welding spot like transition site "P_1 to P_n" ensures a rigid connection of both elements to each other (**Fig.** 17). Ref. to **Fig.** 16 the interengaging assemblies consist of upper and lower engaging pins **1.15** distributed on the respective upper and lower transition areas of juxtaposed crumpling zones of the first deformable element **1e** in x-direction and the mating T-shaped oblong holes, distributed along both legs of the U-shaped portion of the second deformable element **2c**, serving as upper and lower transition sites of juxtaposed crumpling zones thereof. Both deformable elements are interconnected upon the insertion of the mating T-shaped oblong holes into the upper and lower engaging pins in y-direction, which are secured in the U-forms of the mating T-shaped oblong holes by the movement of the second deformable element in x-direction. If necessary, a welding spot like transition site "P_1 to P_n" ensures a rigid connection of both elements to each other (**Fig.** 17). Ref. to **Fig.** 17 the interengaging assemblies consist of engaging pins **1.15** distributed on the upper transition areas of juxtaposed crumpling zones of the first deformable element **1e** in x-direction and the mating T-shaped oblong holes, distributed along the upper leg of the U-shaped portion of the second deformable element **2d**, serving as transition sites of juxtaposed crumpling zones thereof. Both deformable elements are interconnected upon the insertion of the mating T-shaped oblong holes into the engaging pins in y-direction, which are secured in the U-forms of the mating T-shaped oblong holes by the movement of the second deformable element in x-direction. The transition sites "P_1 to P_n" of the lower leg of the U-shaped portion of the second deformable element are welded, bolted or glued to the mating sites of the lower transition areas of juxtaposed crumpling zones of the first deformable element.

Ref. to **Fig.** 18 the interengaging assemblies consist of engaging pins **2.1b**, both ends of which are attached to both legs of the U-shaped portion of the second deformable element **2e**, serving as transition sites of juxtaposed crumpling zones of the second deformable element **2e** and the mating recesses of the first deformable element **1f**, each of which is on one engaging side of a transition area between the juxtaposed crumpling zones provided with guide tubes in the common axis. The corresponding crumpling zones of both deformable elements are interconnected when the engaging pins are inserted into the mating recesses and secured therein by an auxiliary tube **60c** projected through the guide tubes of all the crumpling zones in the common axis.

In analogy to "*guiding a piston rod of an engine*" the *piston rod* must be guided in the 1st to 3rd embodiment of a bearing box attached to or in the portion of a runner.

1) by the sleeve bearings (not shown) in the bearing box attached to the front portion **30.1** of a runner and/or of the A-cross member **31** ref. to **F1** (guidance-type **1**) (**Figs.** 1 to 2). This feature can be applied for the attachment to the rear portion of a runner (**Fig.** 32);
2) by the sleeve bearings (not shown) in the bearing box **30.7, 30.7a** form- and force-locking connected to the runner **30a, 30a1** ref. to **F2** (**Figs.** 25, 26, 29 to 31). The bearing box **30.7, 30.7a** is assembled by positioning and bolting both engaging plates **30.6** to the corresponding guide plates **30.5** via guide pins **30.4** (**Fig.** 25); or
3) by a bore of the bearing box **30.7, 30.7b, 30.7c** made of an extrusion component fabricated from light material, the engaging receptacles of which are plug-in (form-locking) and force-locking connected to the mating parts of the runner **30a, 30a1, 30a2** ref. to **F3** (**Figs.** 27, 28). To save costs the extrusion process is further exploited to manufacture a number of bores of the bearing box **30.7c**, e.g. three bores and the fourth drawn with dotted lines, to guide several piston rods (**Figs.** 32, 33) and receive auxiliary members such as tubes **60c, 60c1, 60c2**.

The cross section of piston rod is arbitrary, however preferably round or rectangular because of the low manufacturing costs. Owing to the space saving design the piston rods can be arbitrarily arranged in the front and/or rear section of the vehicle body.
Generally, a piston device includes at least one piston rod **5.2**,

- one end of which is fastened to the bumper with sites of predetermined fracture or to an impact pan **5.1**, which is located adjacent to the conventional bumper, and
- the other is fastened to a piston **1.2**, which is rigidly connected to the deformable element or spaced at a distance of "l0" thereto (**Figs.** 31, 33). When the piston rod is equipped with a coil spring **4d** or rubber spring **4c**, it telescopes further into the bearing box within the distance of "l0" to store minor energy when the bumper is loaded and to return the bumper to the home position when the bumper is unloaded.

A pair of independently operating front piston devices includes a pair of front *double* bearing boxes **30.7**, connected to the front portions of longitudinal runners according to **F3**, and a pair of front pistons **1.2**, fastened to the front-end portions **1.1** of the front deformable elements **1** (**Fig.** 32).
A pair of independently operating front piston devices includes a pair of front *twin* bearing boxes **30.7**, connected to the front portions of longitudinal runners according to **F3**, and a pair of front pistons **1.2**, fastened to the front-end portion **1.1** of the single deformable element **1** (**Fig.** 33).

A pair of independently operating rear piston devices includes a pair of rear *twin* bearing boxes **30.7**, connected to the rear portions of longitudinal runners according to **F3**, and a pair of rear pistons **1.2**, spaced at a distance of "l0" to the rear-end portion **1.1** of the single deformable element **1** (**Fig.** 33).

Ref. to **Figs.** 1 to 9 the 1st embodiment of a vehicle floor of the compact car "GO", substantially safer than the compact car "AC" shown in **Figs.** 2a, 3a, comprises two bumpers **35, 36** and

- two runners **30**, each of which is subdivided into a rectangular front portion **30.1**, a U-shaped central portion **30.2** (**Fig.** 4) and a rectangular rear portion **30.3**;
- an A-cross member **31**, subdivided into two U-shaped side transverse portions (torsional boxes) **31.1** and a rectangular central transverse portion **31.2**;
- a C-cross member **33**, subdivided into two U-shaped side transverse portions (torsional boxes) **33.1** and an U-shaped and rectangular central transverse portion **33.2** (**Fig.** 9);
- a B-cross member **32**;
- a double U-shaped tunnel rail **60**, welded to all cross members and
- at least one pair of independently operating piston devices, above-mentioned.

Each deformable element **1** of four panels **1.10, 1.11**, provided with soundproofing strips **1.7**, is inserted into the space, defined by the half of double U-shaped tunnel rail **60** and the U-shaped central portion **30.2** (**Fig.** 4). The plate **1.1** of the rear-end portion thereof is secured to the central portion of C-cross member by bolts **1.12** (**Fig.** 9). The plate **1.1** of the front-end portion thereof is bolted to the piston **1.2** of the piston device by bolts **1.5** (**Fig.** 10). Subsequently, the auxiliary plate **6** is secured to the central portion of C-cross member by coupling elements **6.2, 6.7** (**Fig.** 4). The side deformable element **2** with soundproofing strips **2.7**, projected into the U-shaped side transverse portion **31.1** and transverse portion **33.1**, is secured to the auxiliary plate **6**, serving as a fixture by coupling elements **6.1, 6.6** and to the side rail **34** by shearable bolts **2.1** and/or shearable pins **2.1a** with the mating holes of pieces **2.4** of the side rail **34** provided with sound-proofing pieces **2.3** (**Figs.** 4, 7). Under load of the weight of side deformable element **2, 2a** and, particularly, the weight of passenger, standing on the step rail **2.8**, the defection of the element **2, 2a** spoils the overall stylish impression. Doubtless, it is not beneficial to sales. There is a need for a height-adjusting mechanism. To adjust the height a tool is inserted through the overlapping holes of side rail **34** into a hexagon socket head of shearable bolt **2.1** (**Figs.** 4, 7). The number of shearable bolts and/or shearable pins arranged longitudinally and/or transversely depends on the width, length, weight of the deformable element and the weight of passenger standing on the step rail. In excess of the predetermined force in a side collision the shearable parts **2.1, 2.1a** and/or the mating pieces **2.4** with thickness, "a" denoted in **Fig.** 7, are broken or shorn so that the crumpling zones will be fully exploited to absorb energy. Substituting the shearable parts with welding spots cuts the manufacturing cost, but the repair cost will increase. The flat B-cross member **32** can be replaced by an open cross sectional intermediate cross member **32c**, similar to 30a (**Figs.** 23, 24, 33).

Ref. to **Fig.** 23, 24 and 32 the 2nd to 3rd embodiment of a vehicle floor comprises at least one bumper **35, 36** and

- a pair of open cross sectional runners **30a** and a pair of open cross sectional side rails **34a**;
- a pair of U-shaped tunnel rails **60e**, providing a space below the vehicle floor to house any part of power plant such as

* an exhaust pipe of a rear wheel drive vehicle and a drive shaft or
* an exhaust pipe of a front wheel drive vehicle;

- three closed cross sectional cross member **31a to 33a, 31b to 33b**, rigidly connected to the runners **30a**, tunnel rails **60e** and side rails **34a**; and
- at least one pair of the above-mentioned, independently operating piston devices.

Each of the two pairs of deformable elements **1** (**Fig.** 32) is projected through the open cross sectional side rails **34a** and the open cross sectional central portions of runners **30a** into the U-shaped tunnel rail **60e**. Either two pairs or one pair of side deformable elements **2a1, 2a2, 2a3** are projected through the respective open cross sectional portions of side rails **34a** into the respective side portions of deformable elements **1** in juxtaposition. Each side deformable element has step rail **2.8** (**Fig.** 6). Regarding the 2nd embodiment the three cross member **31a to 33a** are provided with assembling bores "b_1 to b_{an}" at the side region and "e_1 to e_n" at the central region in common axes to receive and to secure at least two pairs of auxiliary tubes **60b, 60c, 60c1, 60c2**, when projected therethrough and through the deformable elements **1** and the side deformable elements **2a1, 2a2, 2a3**. When the auxiliary tube **60b, 60c** is too long for projection, it is replaced by two short auxiliary tubes **60c1, 60c2** or by auxiliary plates (**Figs.** 23, 24, 32).
Regarding the 3rd embodiment the three cross member **31b to 33b** are provided with the respective auxiliary plates **31.5 to 33.5** at the side region and a pair of auxiliary plates **32.6** at the central region of cross member **32b**. The deformable elements **1** and the side deformable elements **2a1, 2a2, 2a3** are fastened to the assembling points $\mathbf{R_1, R_2, R_3, \ldots, R_n}$ of the respective auxiliary plates **31.5 to 33.5** and the assembling points $\mathbf{Q_1, Q_2, Q_3, \ldots, Q_n}$ of auxiliary plates **32.6** (**Fig.** 24).

Ref. to **Fig.** 29 the 4th embodiment of a vehicle floor, each of two multi-leaf springs **4a** ref. to **G10**, serving as a deformable element **1**, is transversely mounted to the A-cross member **31a**. For example this multi-leaf spring comprises three leaves **B1, B2, B3**. To protect passengers in a rear collision another multi-leaf spring can transversely be mounted to the C-cross member **33a**.

Ref. to **Fig.** 30 the 5th embodiment of a vehicle floor, a multi-leaf spring **4b** ref. to **G10**, serving as a deformable element **1**, guided by the open cross sectional runner **30a** is longitudinally mounted to a stiff member **60a** on each vehicle side to protect passengers in a front or rear collision.

Ref. to **Fig.** 31 the 6th embodiment of a vehicle floor comprises two bumpers **35, 36** and

- a pair of open cross sectional runners **30a** and a pair of open cross sectional side rails **34a**;
- an open cross sectional tunnel rail **60d**,
- three closed cross sectional cross member **31a, 32c, 33a**, rigidly connected to the runners **30a**, tunnel rail **60d** and side rails **34a** and provided with bores in the common axes;
- at least one pair of the above-mentioned, independently operating piston devices, equipped with a pair of springs **4d** and
- an energy-absorbing assembly for a trunk compartment (**Fig.** 19), undermentioned, or a deformable floor **3c**, fastened to both rear portions of longitudinal runners **30a** and the rear cross member **33a**.

A single deformable element **1**, inserted between the front **31a** and rear cross member **33a**, through the side rails **34a**, longitudinal runners **30a**, tunnel rail **60d** and intermediate cross member **32c**, is in abutting relationship to both vehicle sides and secured by two pairs of auxiliary tubes **60c**, projected therethrough and through the bores of front and rear cross member in the common axes and fastened to the front and rear cross member.
The deformable element, the rear-end portion of which is fastened to the rear cross member,
- absorbs impact energy in any front collision while moving along the auxiliary tubes; or
- is deformed at the side portion in any side collision.

Ref. to **Fig.** 33 the 7th embodiment of a vehicle, having the same vehicle frame as the 6th embodiment, is provided with a pair of the above-mentioned, independently operating front twin piston devices and a pair of the above-mentioned, independently operating rear twin piston devices.
A single deformable element **1**, inserted between the front **31a** and rear cross member **33a**, through the side rails **34**, longitudinal runners **30a**, tunnel rail **60d** and intermediate cross member **32c**, is in abutting relationship to both vehicle sides and secured by a pair of auxiliary tubes **60b**, projected therethrough and through the bores of front and rear cross member in the common axes and fastened to the intermediate member.
The deformable element, fastened to the intermediate cross member **32c**,
- absorbs impact energy in any front collision while moving along the auxiliary tubes; or
- is deformed at the side portion in any side collision.

Ref. to **Figs.** 1, 2, 19, 20 the 1st embodiment of a rear deformable element **3** of the trunk compartment comprises a central deformable member **3.1** and a pair of side deformable members **3.2** pivotally connected thereto with hinges **3.3**. Rooms between the detachable deformable element **3, 3a**, the rear wall of the passenger compartment, the rear wall of rear bumper **36**, both wheel cases **40**, both rear portions **30.3** and the lower floor of the trunk compartment can be used for storage. The engaging pins **3.5** of the deformable member **3.1** are longitudinally arranged parallel to the mating holes of the rear portions **30.3**, distance "T" indicated in **Fig.** 19. The length of deformable element **3** almost equals the depth of trunk compartment.
The detachable deformable element **3, 3a**, serving as the upper floor of the trunk compartment, is in form-locking connection with the pair of rear portions of longitudinal runners and both rear wheel cases **40**, in abutting relationship to the rear cross member **33** and the rear wall (not drawn) of rear bumper **36** as well as being releasable therefrom **(Figs.** 1, 21).
By means of both hand grips **3.4** of the deformable members **3.2**, folded up, the engaging pins **3.5**, drawn with dotted lines **(Fig.** 19), of deformable member **3.1**, resting on the rear portions, are placed adjacent to the mating holes **(Fig.** 1). Because the diameter of the head of each engaging pin is a little smaller than the sidelong width of each mating hole, the sidelong hand movement illustrated by arrow and "S" **(Fig.** 19) moves all engaging pins into the mating holes for the purpose of form-locking connection. When folded down, the deformable members **3.2** cover both storage rooms "SL" and "SR",
- the lateral surface of each deformable member **3.2**, having engaging holes, is in form-locking connection with the C-shaped rear wheel case **40**, whereto mating pins **40.1** are rigidly attached; and
- the holes engage with the mating pins **40.1**.

The number of the interengaging assemblies engaging pins / mating holes, e.g. five, determines the number, e.g. six, of crumpling zones of the deformable element **3** (**Figs.** 1 and 21).

Ref. to **Figs.** 21, 22 the 2nd embodiment of a deformable element **3a** of the trunk compartment comprises a central deformable member **3.1a** and a pair of side deformable members **3.2a**. The design parameters of this embodiment without hinges **3.3** such as distances, lengths, shapes etc. are similar to the 1st embodiment.
The deformable member **3.1a** is provided with two rows of the engaging pins **3.5a** to engage with the mating holes of both rear portions **30.3**. The number of the interengaging assemblies engaging pins / mating holes determines the number of crumpling zones Z_1, Z_2, Z_3, Z_4,.. Z_6 of the deformable element **3a** in direction of impact force **X1**. The crumpling zones in both directions of impact forces **X1** and **Y** will be defined, when the deformable member **3.1a** is additionally provided with a transverse guide beam **3.8**, having engaging pins **3.7** which engage with the mating holes of the cross rail **3.9** rigidly attached to the C-transverse portion **33.2** of the cross member, thus optimizing the deformation behaviour of the deformable element **3a**.
The schema illustrated by arrows (**Fig.** 22) shows the form-locking connection of all engaging pins **3.5a, 3.7** to the mating holes of both rear portions and of that cross rail along which the inner edge of the guide beam **3.8** slides. Additional costs will be incurred only for manufacturing and assembly of parts **3.8, 3.9** due to preserving the distances of the corresponding interengaging assemblies thereof.
When lowered down, each deformable member **3.2a** covers a storage room "SL" or "SR" and is in form-locking connection of

- its lateral surface to the C-shaped rear wheel case **40**;
- its engaging holes to the mating pins **40.1**, rigidly attached to the wheel case **40** and
- its engaging pins **3.6a** to the mating holes of rear portion **30.3** and recesses of deformable member **3.1a**.

Ref. to **Fig.** 31 the 3rd embodiment of a deformable element **3c** of the trunk compartment is in form- and/or force-locking connection with both rear portions **30.3** of the runners **30a** and/or the C-cross member **33a** via interengaging assemblies, similar to those of the deformable element **3, 3a**, welding and/or bolting. The deformable element **3c** can serve as a lower floor of storage rooms, shown in **Fig.** 19.

Although the present invention has been described and illustrated in detail, it is clearly understood that the terminology used is intended to describe rather than limit. Many more objects, embodiments, features and variations of the present invention are possible in light of the above-mentioned teachings. Therefore, within the spirit and scope of the appended claims, the present invention may be practised otherwise than as specifically described and illustrated.

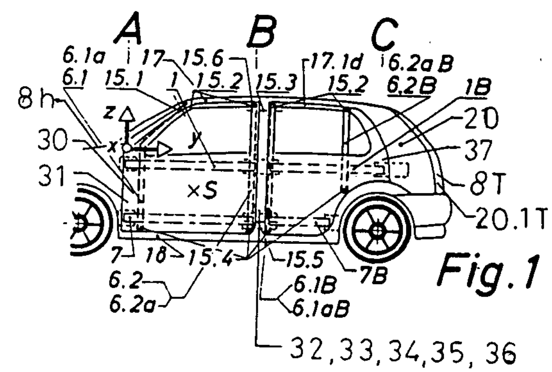

A
B
C
6.1a
6.1
15.1
17
1
15.6
15.2
15.3
17.1d
15.2
6.2aB
6.2B
1B
8h
30
31
z
x
y
S
20
37
8T
20.1T
7
18
15.4
6.2
6.2a
15.5
6.1B
6.1aB
7B
32,33,34,35, 36

Fig.1

Fig. 1B

Prior Art

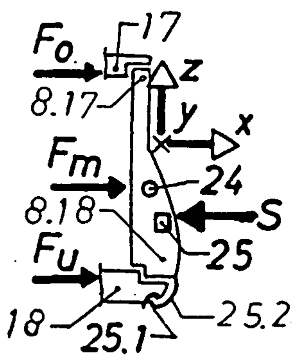


Fig. 1A

Prior Art

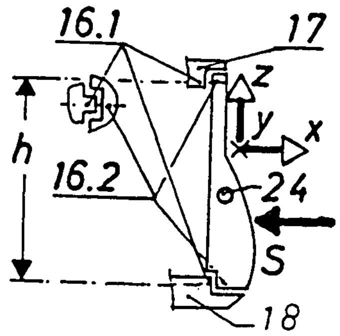
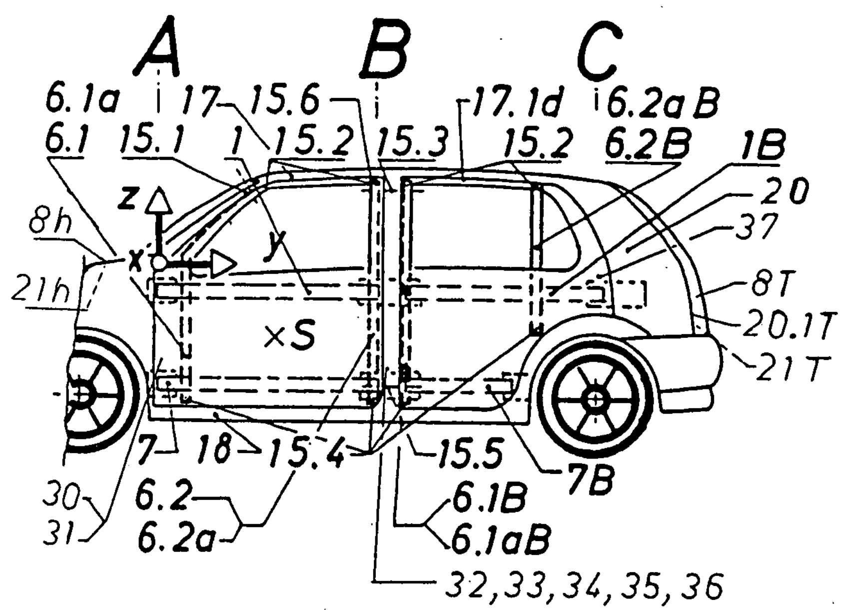
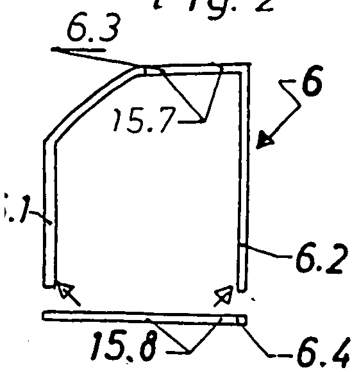


Fig. 1



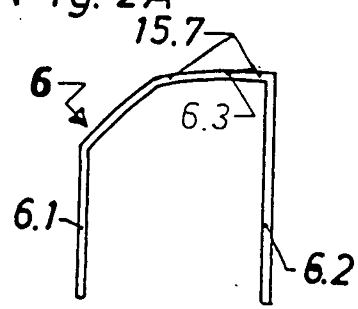
Prior Art

Fig. 2



Prior Art

Fig. 2A



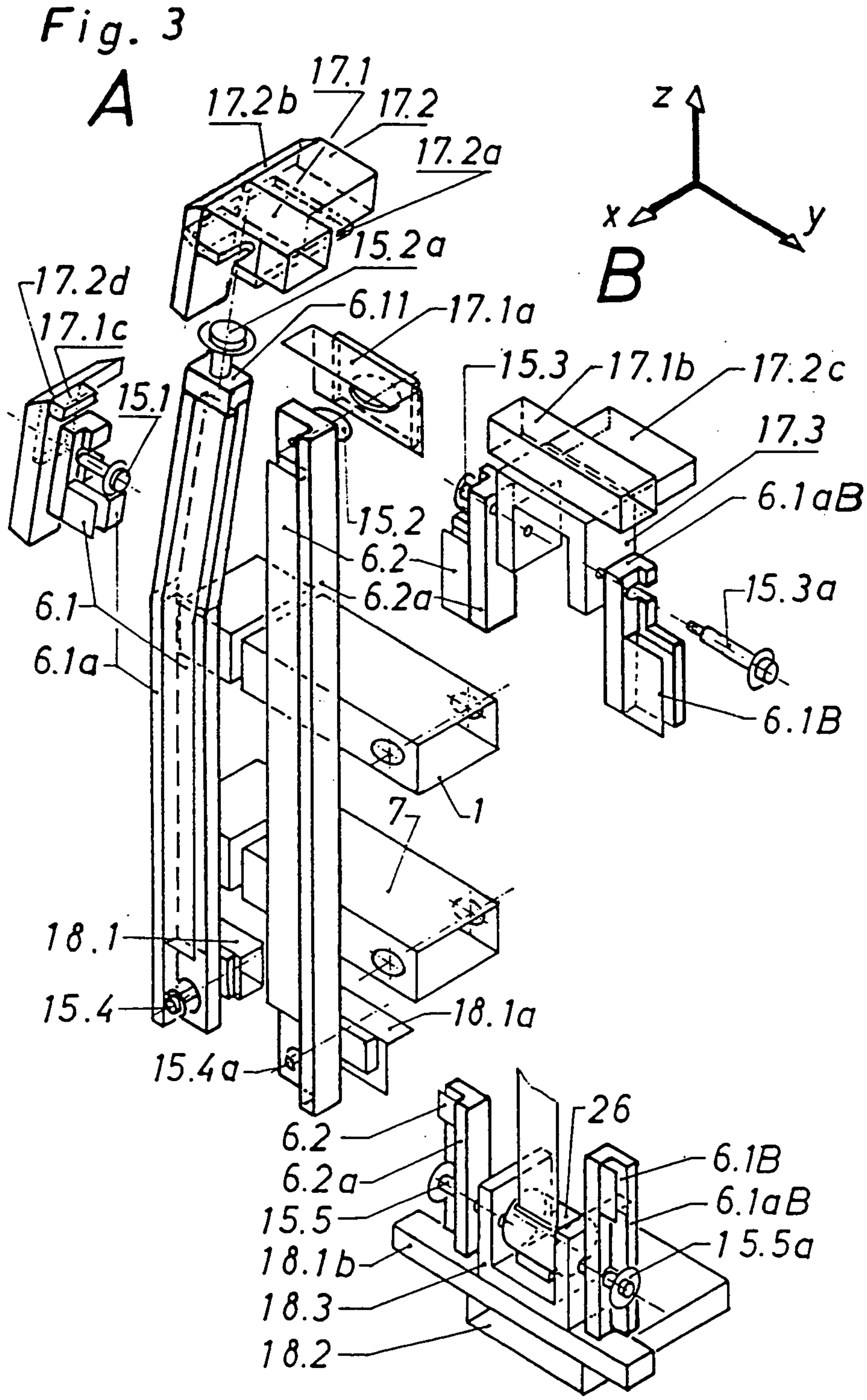


Fig. 3
A
B
z
x
y
17.1
17.2b
17.2
17.2a
15.2a
17.2d
17.1c
6.11
17.1a
15.1
15.3
17.1b
17.2c
17.3
6.1aB
15.2
6.2
6.2a
6.1
15.3a
6.1a
6.1B
1
7
18.1
15.4
18.1a
15.4a
6.2
26
6.2a
6.1B
6.1aB
15.5
15.5a
18.1b
18.3
18.2

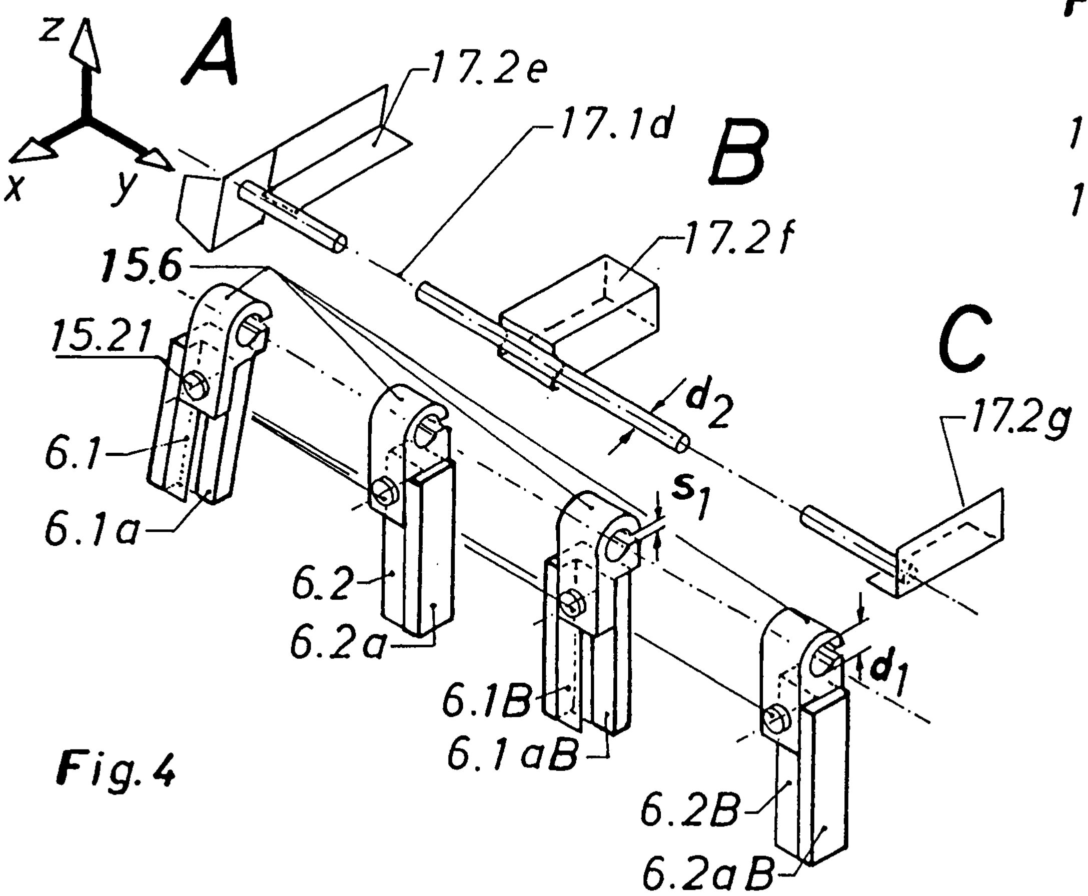


Fig. 4

Fig. 4A

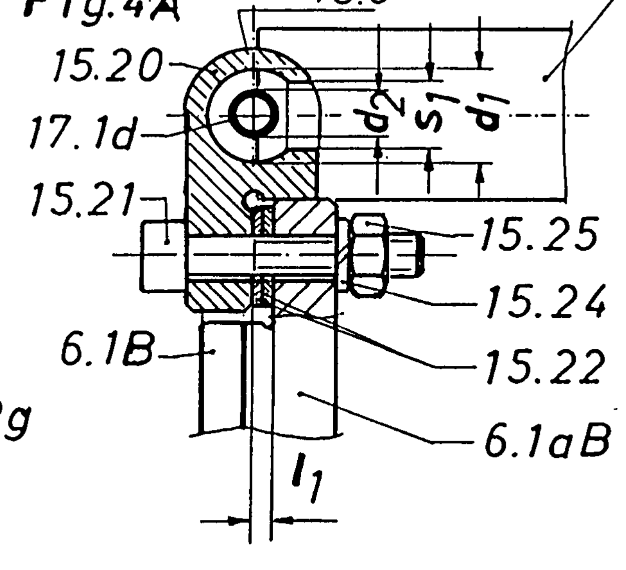
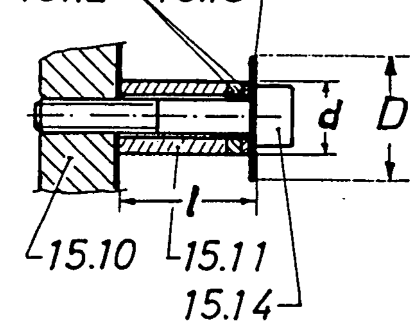
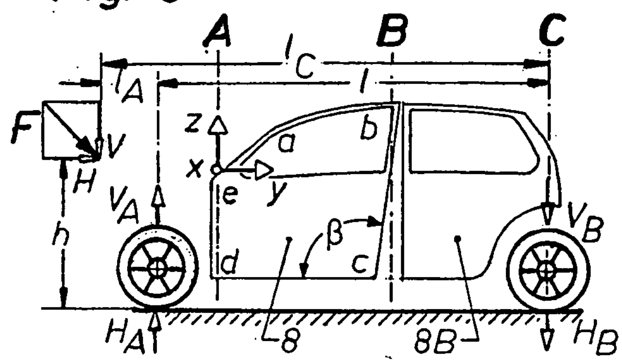


Fig. 3A



Prior Art

Fig. 5



Prior Art

Fig. 6

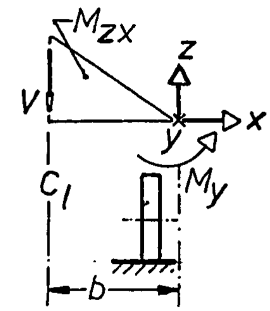
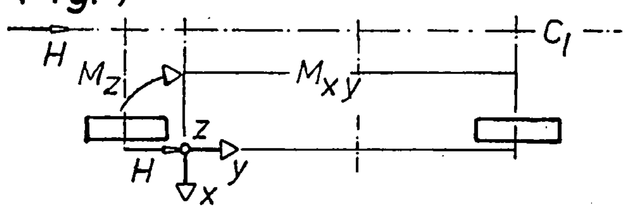


Fig. 7

Prior Art



Prior Art

Fig. 8

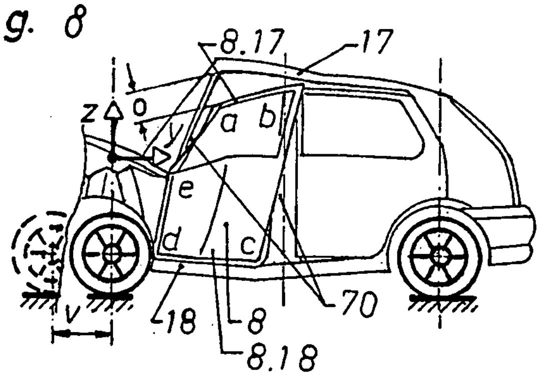
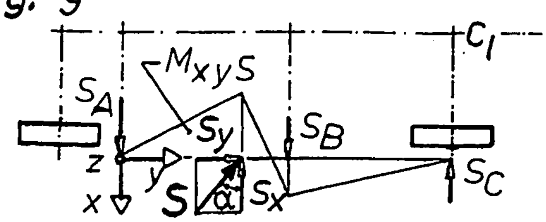


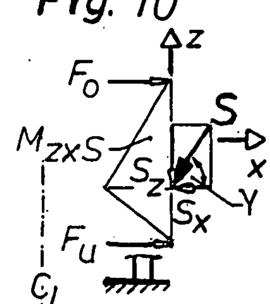
Fig. 9

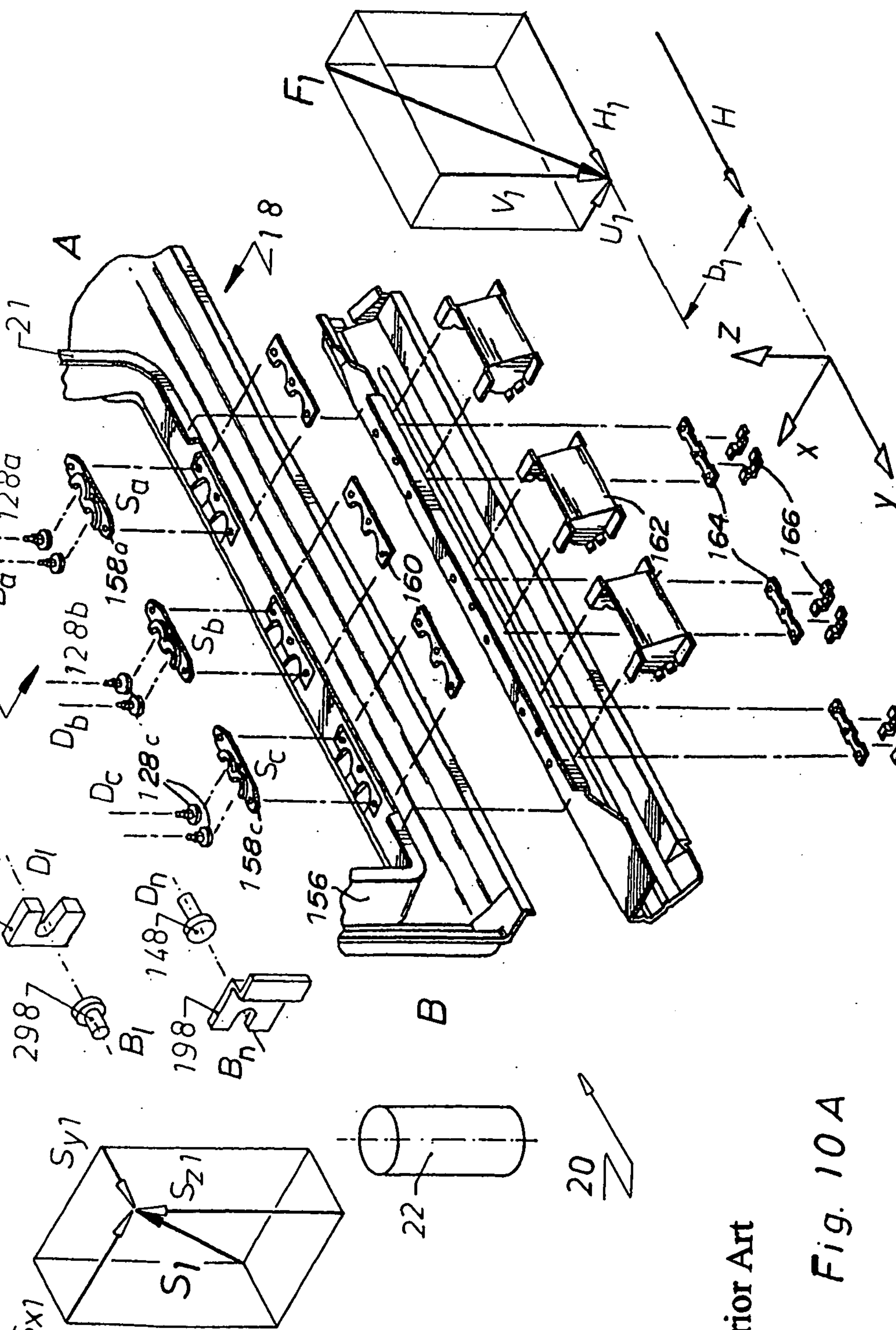
Prior Art



Prior Art

Fig. 10





Prior Art

Fig. 10A

Prior Art

Fig. 11

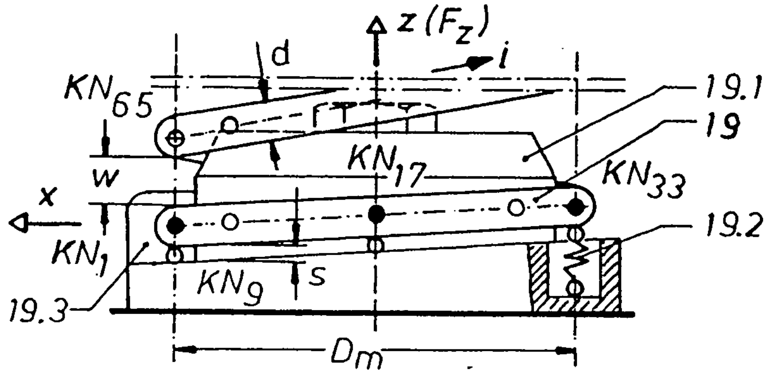


Fig. 12

Prior Art

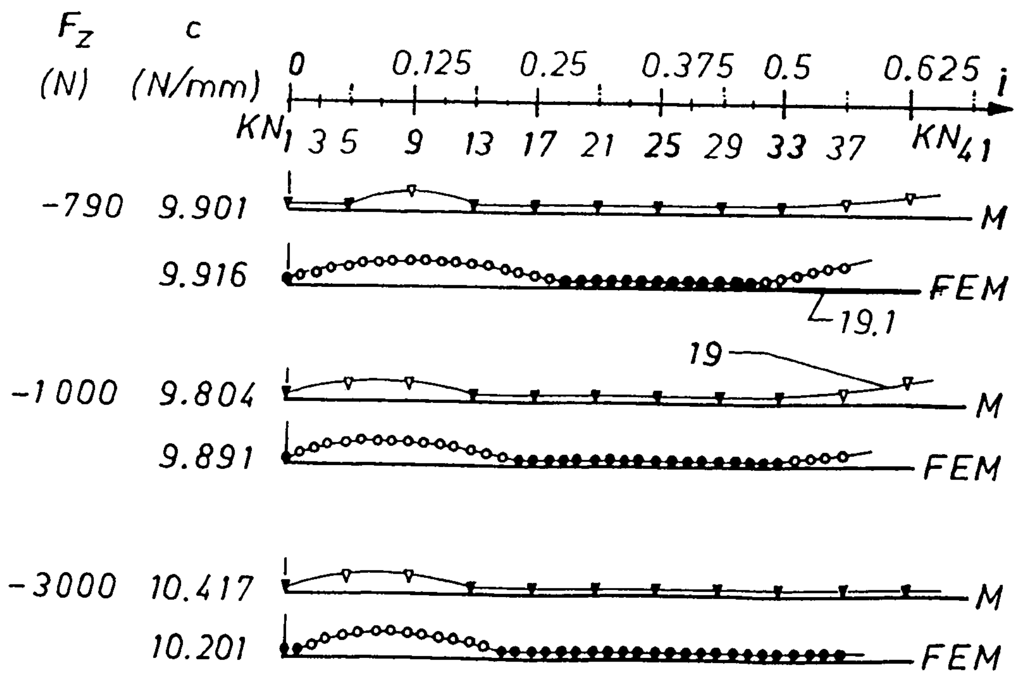


Fig. 13

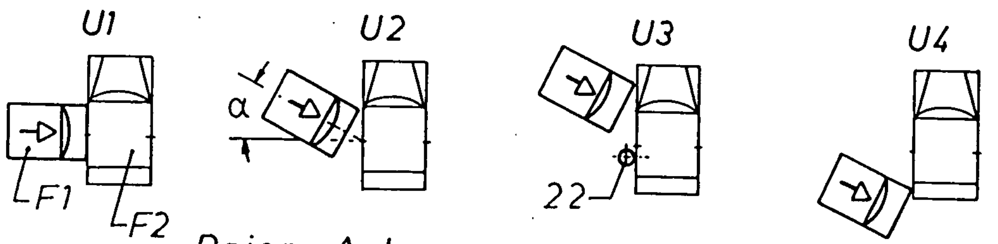

U1
U2
U3
U4
α
F1
F2
22
Prior Art

Fig. 14

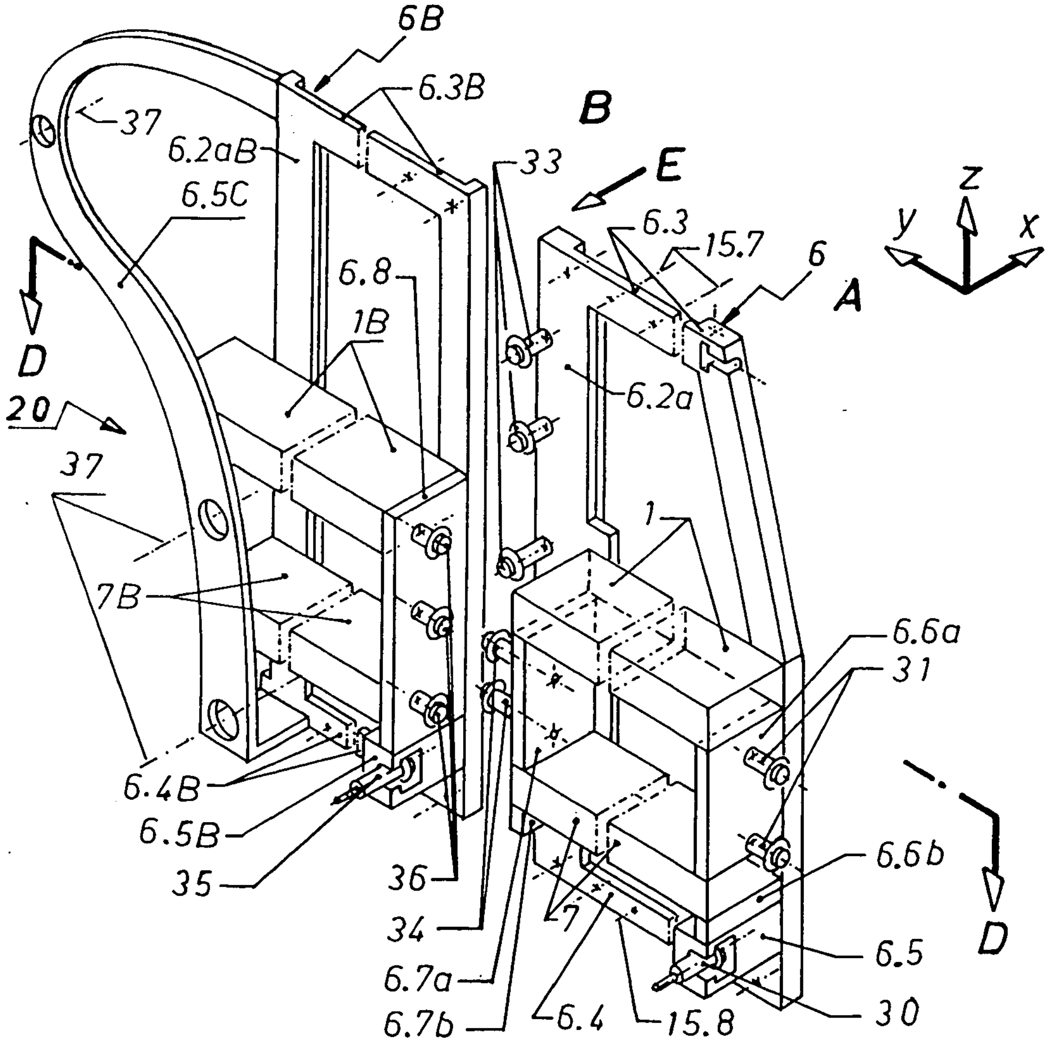
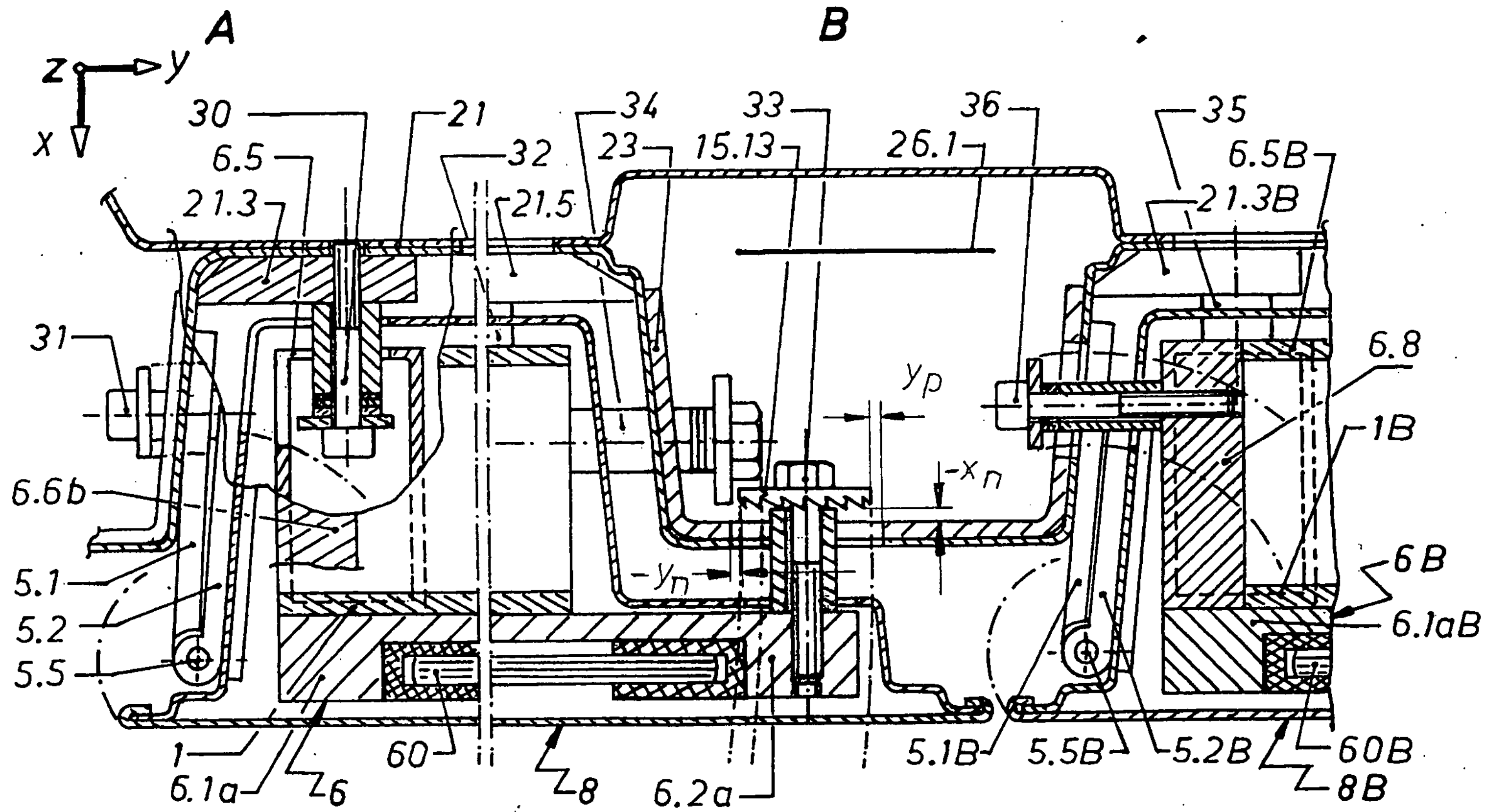

6B
6.3B
B
37
6.2aB
33
E
6.5C
6.3
15.7
6
A
z
y
x
6.8
1B
D
6.2a
20
37
1
7B
6.6a
31
6.4B
6.5B
35
36
34
6.6b
6.5
D
7
6.7a
30
6.7b
6.4
15.8

Fig. 15


A
B
z
y
x
30
6.5
21.3
21
32
21.5
34
23
15.13
33
26.1
36
35
21.3B
6.5B
6.8
1B
6B
6.1aB
60B
8B
31
6.6b
5.1
5.2
5.5
1
6.1a
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8
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5.5B
5.2B
y_p
$-x_n$
$-y_n$

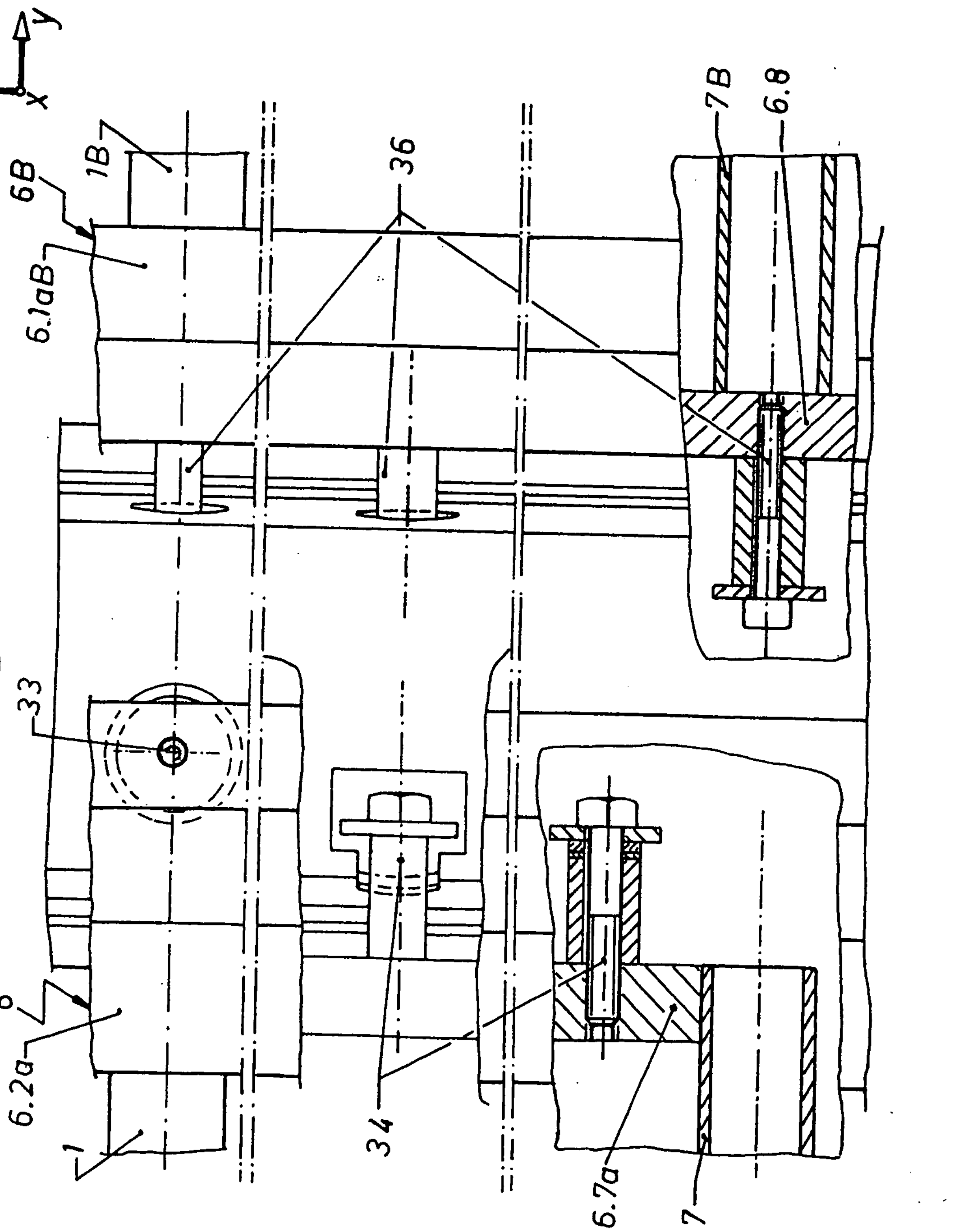


Fig. 16 B

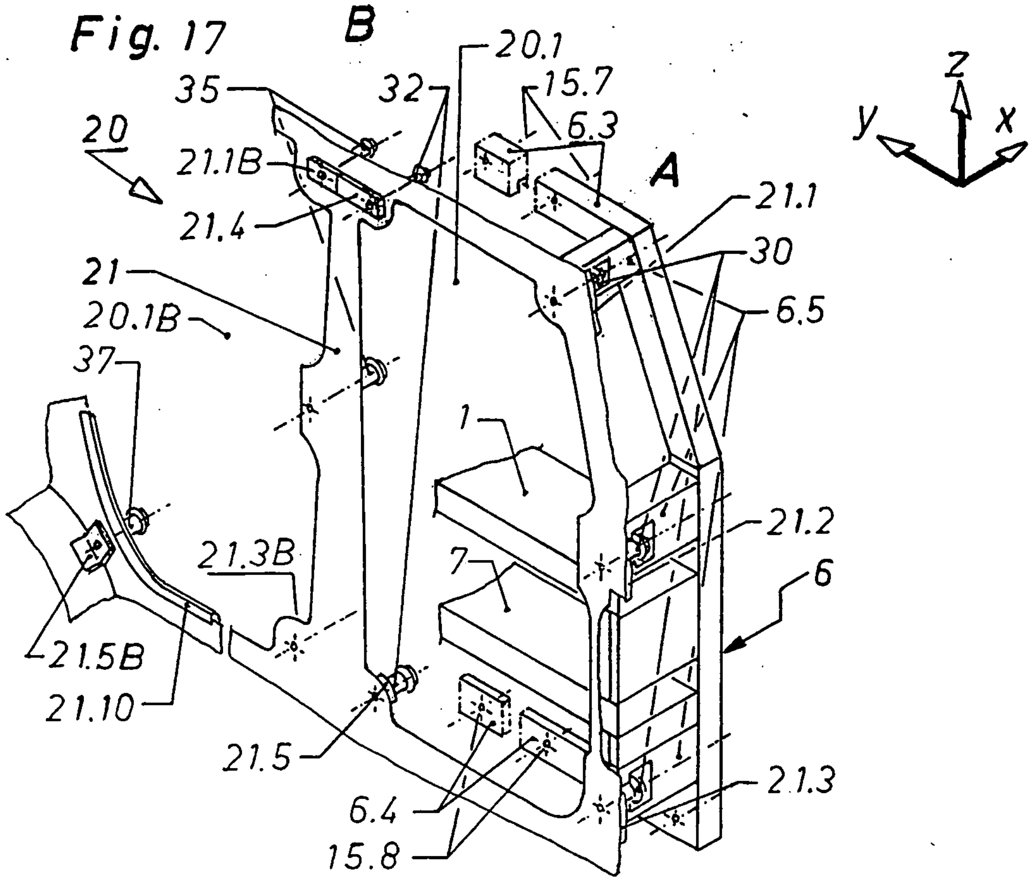


Fig. 17

Prior Art

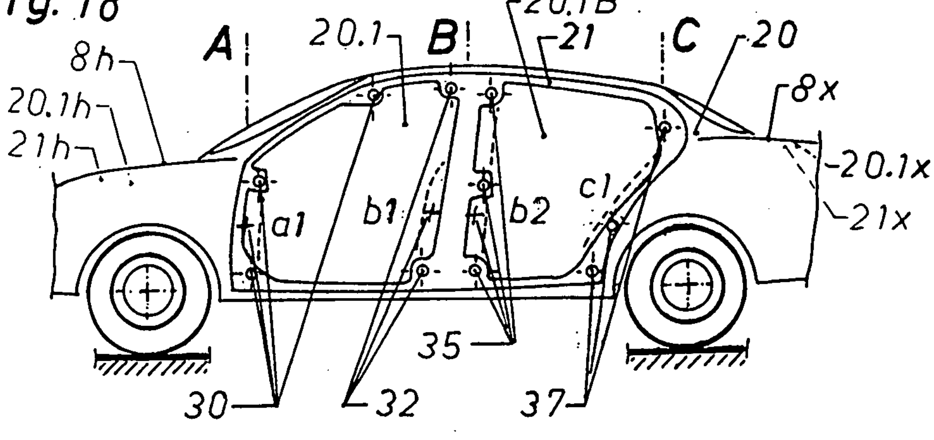


Fig. 18

Fig. 17

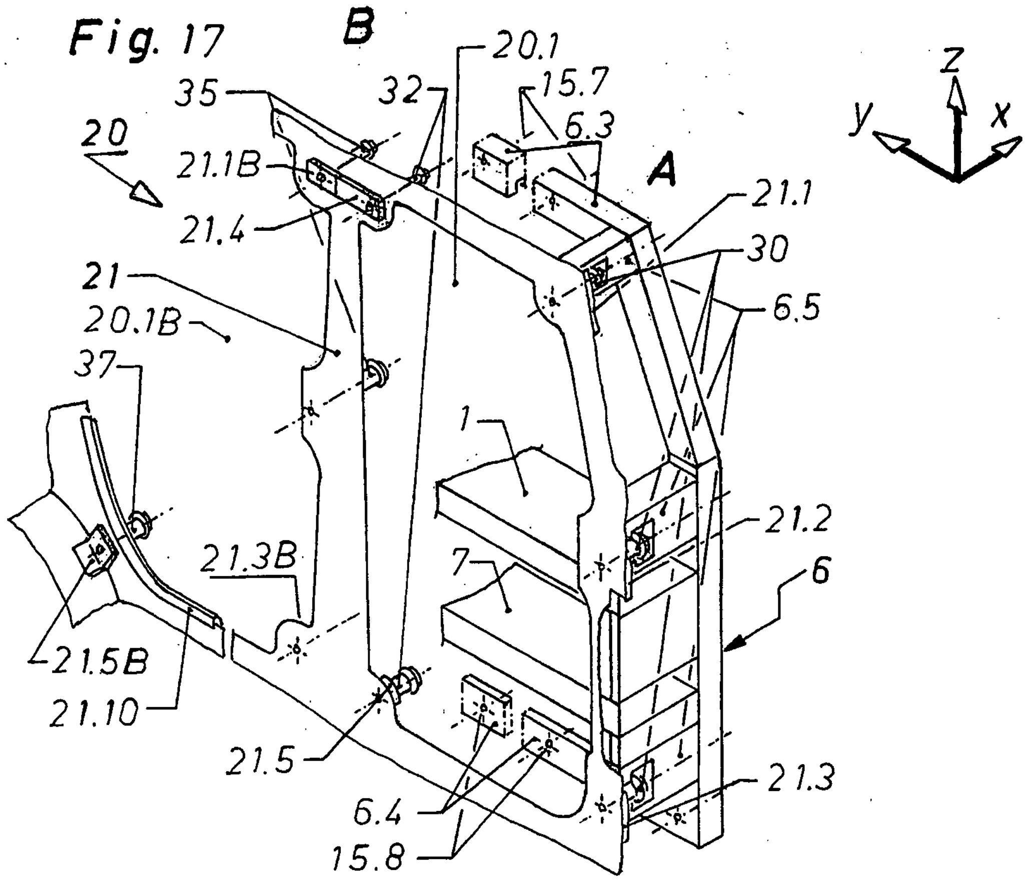
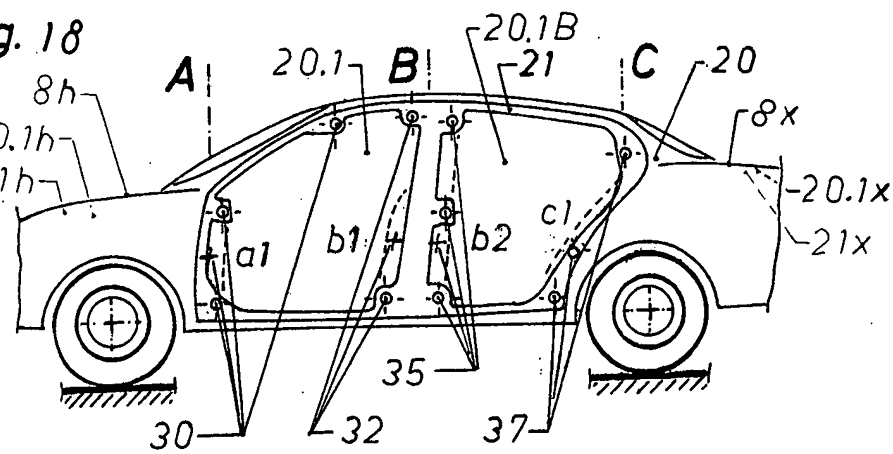

B
20.1
15.7
35
32
6.3
20
21.1B
A
21.1
21.4
30
21
6.5
20.1B
37
1
21.2
21.3B
7
6
21.5B
21.10
21.5
21.3
6.4
15.8
z
y
x

Fig. 18


20.1B
A
20.1
B
21
C
20
8h
8x
20.1h
20.1x
21h
a1
b1
b2
c1
21x
35
30
32
37